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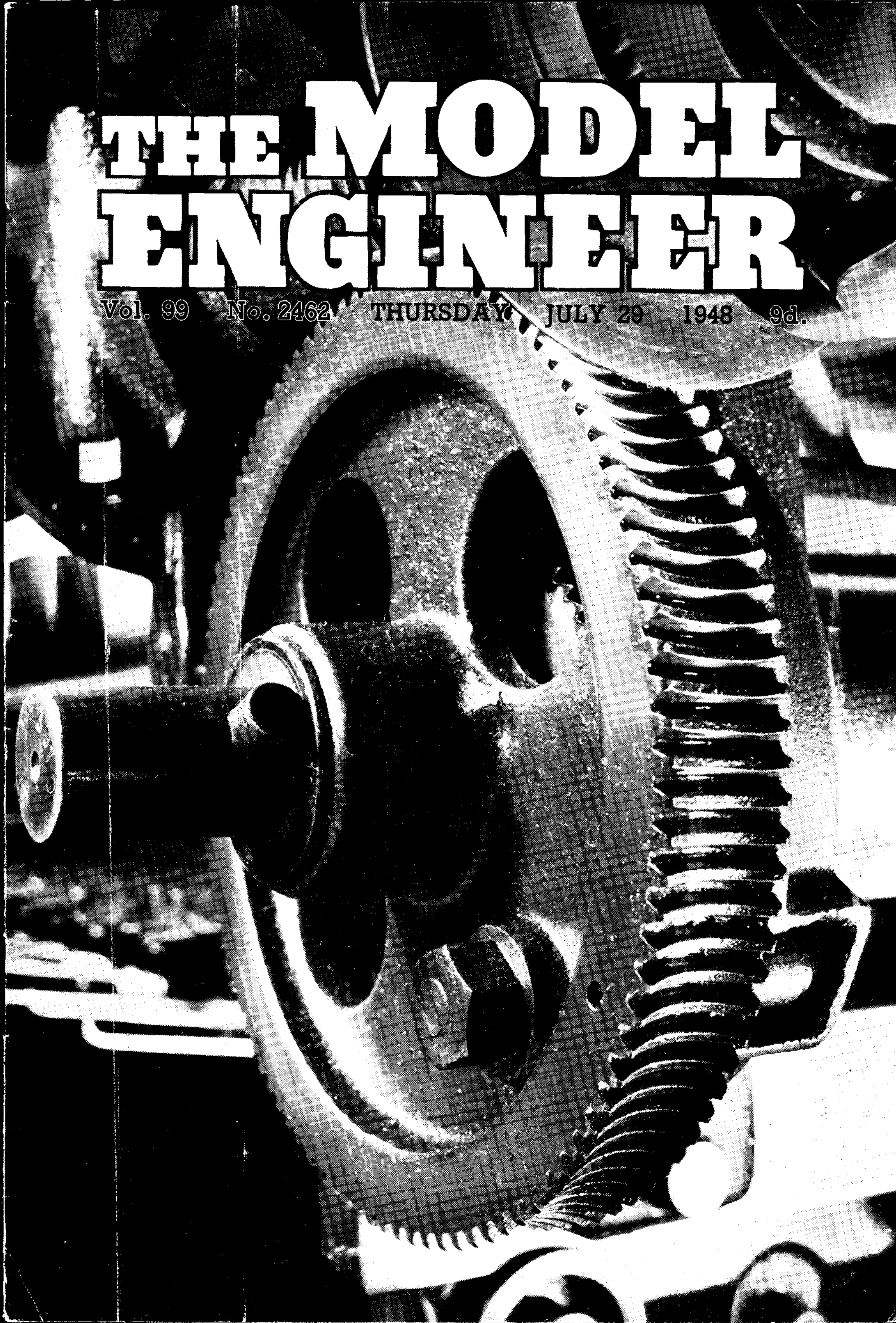


The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, *GREAT QUEEN ST.*, *LONDON, W.C.2*

29TH JULY 1948 VOL. 99. NO. 2462

SMOKE RINGS

Our Cover Picture

● THE EXCELLENT photograph of a worm wheel which has been selected for this week's cover will, I hope, have the same fascination for readers that it has for me. Apart from the technical perfection of the photography, the tremendous multiplication of torque which is possible by the use of these gears is something which always fascinates me. It is difficult to explain just what I wish to convey, but I remember the thrill experienced when I found myself quite unable to stop a miniature series motor, by applying my fingers to the shaft of the worm gear which had been fitted. I gained more satisfaction from the slow, irresistable power provided by the motor driving through a worm gear than I did from the screaming revolutions it developed when running light.—P.D.

Amenities at THE MODEL ENGINEER Exhibition

● THIS YEAR it has been necessary to take a larger part of the New Horticultural Hall building to provide for the comfort of visitors and also for the overflow of exhibits. As before, meals can be supplied in the restaurant on the lower ground floor; also, this year, the annexe to this restaurant will be in use for the supply of light refreshments and teas throughout the opening hours of the exhibition. On the first floor, in addition to some very interesting club exhibits, a rest room has been provided where wives and families who have seen the rest of the exhibition to their satisfaction, can wait in comfort while the male section of the family makes a detailed study of its favourite exhibits.

On the second floor a bar will be provided where thirsty souls can discuss the pros and cons of petrol versus diesel while partaking of their own favourite fuel.—P.D.

The Coming Generation

● WHEN PEOPLE come to me and complain that craftsmanship is dead or dying, I usually suggest that they should think again! I believe that every human being, male and female, is born with a greater or less portion of the faculty that is known as craftsmanship; subsequent training and encouragement will develop it, otherwise it simply remains dormant. The Junior section of the "M.E." Exhibition contains a number of entries for competition, and the ages of the entrants range from 12 to 17 years. The variety of the entries shows that the choice of subjects is a commendably wide one; there is certainly

very little indication of "centralisation" of interest! A lad of 12 is submitting a stationary horizontal steam engine, *designed by himself*. Another, not yet 15 years old, has chosen a London Transport garage and section of road with a number of buses, measuring, in all, 2 ft. by 1 ft. 6 in. A delightful enterprise is shown by a youngster of 15 years, who is sending in two "O" gauge wagons, made of wood and cardboard, from drawings he made from memory of prototypes seen in Feltham Yard. A really bold effort is the 2½-in. gauge L.N.E.R. 2-6-2 "Green Arrow" locomotive, at present unfinished and without a tender, entered by a competitor aged 14 years 7 months. To me, these are typical of the kind of thing that confronts me almost every time I visit a model engineering exhibition, no matter where. I have no qualms as to the future of model engineering, so long as proper guidance of the rising generation is maintained.—J.N.M.

Exhibition Posters

● A COLOURED poster has been prepared for the "M.E." Exhibition and we shall be pleased to send one or more copies to any reader who will kindly undertake to display them in suitable effective positions. For those who cannot give space to the large poster, a small bill is available which would be very appropriate for works and office notice boards, and shop windows. Copies may be obtained on application to the Exhibition Manager, 23, Great Queen Street, London, W.C.2. Please state which of the two sizes is required, or if use can be made of both of them.

Air Commodore Sir Frank Whittle

● THE RECENT award of £100,000 free of tax to Air Commodore Sir Frank Whittle has focused attention upon the gas turbine engine and also upon his extreme modesty which is characteristic of true genius. This material award and high honour, unsought by the recipient who, in fact, insisted all along that he was indebted to the country rather than the reverse, is complementary to that which comes to those who are rewarded by seeing their life's ambitions successfully fulfilled. To many, the attitude of mind, which regards financial considerations as of little or no importance is difficult to understand, but to model engineers, whose only reward for what is sometimes years of work is satisfaction in a job well done and the joy of doing it, it is something they have in common with the inventor and the scientist, whose real reward lies in their absorbing interest in their daily work and the joy of achievement. In the march of engineering progress, the name Whittle will stand out in history to mark the close of one era and the opening of another. The development of the gas turbine is only now beginning and the road stretching out before us holds the promise of exciting possibilities and developments which will revolutionise the transport world. Already we have news from The Rover Co. of an engine developing 33 per cent. more h.p. than the conventional reciprocating engine which it replaces, whilst occupying approximately only half the space. How long it may be before the reciprocating piston engine becomes obsolete, or a working model gas turbine can be produced, none can say, but that these things will come to pass can be regarded as almost certain.—P.D.

An Exhibition for Leicester

● THE LEICESTER Society of Model Engineers will be holding its ninth exhibition from August 30th to September 4th, 1948, in St. Mark's Schools, Belgrave Gate, Leicester. It is almost two years since the last show was held, which proved to be the most successful so far. This year it is intended to put on an even better show; and to give visitors a better chance of seeing this in comfort, the exhibition will be open for six days instead of the usual three. The times of opening will be 2 p.m. to 9 p.m. each day except Saturday, when the doors will open at 10 a.m. closing at 9 p.m. The official opening will be performed by the president of the society, F. W. Chapman, at 7 p.m. on the Monday. Mr. Chapman is a founder member of this society, the history of which goes back to pre-1914. Mr. Chapman has stuck to the society in all its ups and downs, and it is through his great determination, that the society owes its popularity amongst the Midland clubs. Apart from some very fine work now being turned out by members, the society has also been promised some nice models by members of the various Midland societies, and as many of these have not been on show before, it can be safely said that 50 per cent. of the models to be on view will be entirely new. As well as the passenger-carrying track, there will, of course, be the usual compressed air-driven models and models run by other power, either electricity or steam. There will also be a number of trade stands which will have on display, tools, materials, etc., for the modelmaker.—W.H.E.

The Locomotive Tests

● I AM wondering if it would not be possible for the Railway Executive to give us, after all, something like an official report of the performances put up by the various locomotives taking part in the recent interchange tests. Unfortunately, editorial duties prevented my seeing very much of the tests myself, with the result that I have nothing to add to what I have already published. But from various enthusiasts I have received as many varied reports, so many of which either flatly deny or contradict others, that I am forced to conclude that they are not altogether untainted with "wishful thinking"!

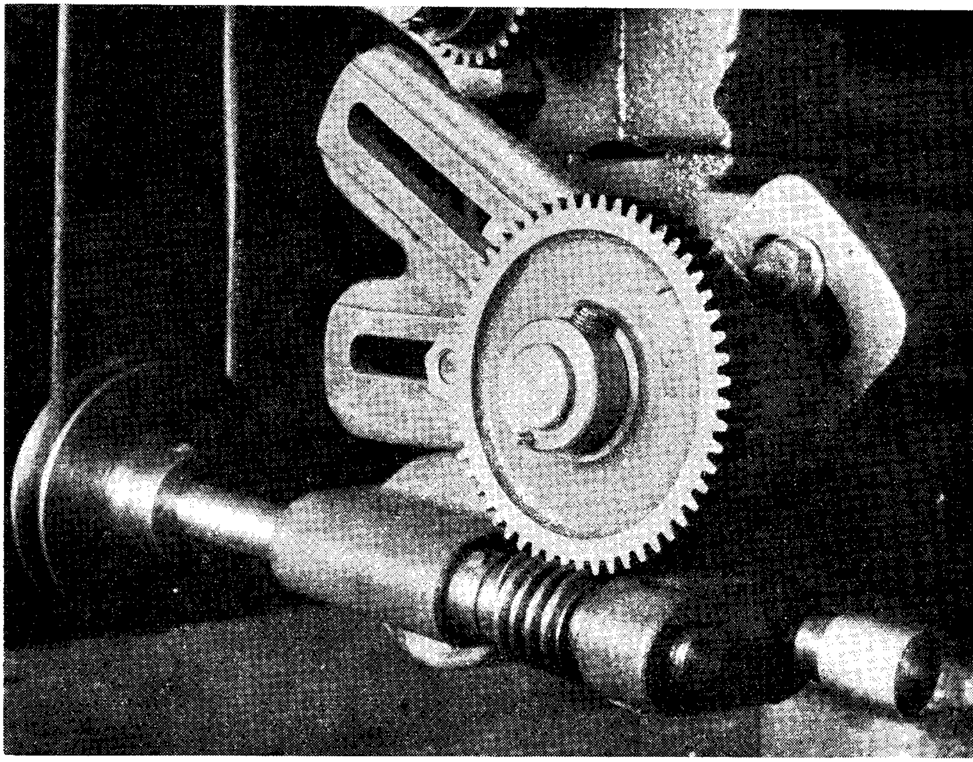
What is certain, however, is that no speed records have been broken, in spite of much anticipation in this direction by a few optimistic individuals; but no record-breaking was intended. To me, it is clear that none of the engines has had any difficulty in working the turns allotted to her, even if, at the end, no definite evidence exists to enable us to say that any engine has come out best.

The technical data gleaned by the dynamometer staffs concerned will no doubt be carefully sifted and examined; the results will probably influence the design of future locomotives for the respective kinds of duties, and that, I think, is all that we can expect.—J.N.M.

*A Superfine Feed Attachment

by "Ned"

THE rocking bearing bracket, also specified as a casting, could be fabricated by brazing, bolting or riveting the bearing blocks to a flat plate. If it is desired to incline the shaft centre to obtain more perfect meshing of the worm, this should be done by setting out the shaft line at the required angle and marking the centre points on the end faces of the bosses. As already stated, this has not been done in the example shown, the shaft centre being parallel to the face of the pivot boss. In either case, however, the boring of the bearing may be carried out by deeply indenting the centres at each end with a centre-drill, and supporting one end on the back centre of the lathe, while drilling the other by a drill held in the chuck. It is best to start with a drill no larger than about $\frac{3}{8}$ in., and open out afterwards to $\frac{1}{2}$ in. reamering size, then finish with a hand reamer. The inner faces of the hole in the gap between the bearings, should be spot-faced with a cutter held in a $\frac{1}{2}$-in. boring bar. These methods will be found most convenient if only a small lathe is available, and are quite satisfactory for the standard of accuracy required ; but if the lathe is large enough, it is more workmanlike to set the bracket up by holding the seating boss end in a four-jaw chuck, and drilling, boring and facing it by orthodox methods.



A view of the attachment fitted to the lathe (in engaged position)

The facing of the seating boss, and drilling and tapping the pivot hole, should, in any case, be done in the chuck, a smaller lathe being adequate for this operation. Drill the hole for the latch plunger from the outer end, using either a drilling machine, or supporting the work on the back centre with the aid of a packing-piece long enough to reach beyond the seating boss, and counterbore from the other side with a long $\frac{3}{8}$-in. drill or counterbore.

Worm

For maximum durability this should be made in steel and case-hardened, but there are some advantages in making it in softer material, so that in the possible event of heavy wear or

* *Continued from page 77 "M.E.," July 15, 1948.*

stripping, this component, which is readily replaceable, will suffer rather than the change-wheel. Not that there is any reason to anticipate any trouble on this score, however, as there is only the barest risk of it happening through bad meshing or gross overload of the gear.

The pitch of thread specified for the worm is 6 t.p.i., which does not correspond exactly with the true circumferential pitch of the 20-D.P. change-gears fitted to the lathe, but is sufficiently close for satisfactory working, within the limits of duty required. It should be noted that a worm gear has some latitude of accommodation in this respect, except where the maximum transmission efficiency is required, when both the pitch and meshing depth are extremely critical. The thread is of Acme form, having the sides inclined at an included angle of 29 deg., but it is cut deeper than standard depth to take the fullest possible advantage of the depth of the gear teeth under the particular conditions of working. The threads should also be thinned somewhat on the lands, as backlash is of little consequence ; here again, no attempt is made to represent this as correct gear-cutting practice, but it produces the desired results, and the fastidious worker who is not satisfied with this may improve upon it and introduce refinements as he wishes.

No provision is made to take end thrust of the worm, as it is never very heavy, but a loose thrust-washer of hardened steel or bakelite may be introduced at either end, between the worm and the faces of the bearings, if desired, the worm being reduced in length to allow for this. A taper pin is specified for securing the worm to its shaft, but a tightly fitted parallel pin, or a sunk grub-screw, are effective substitutes.

The worm may be cut on any lathe with an 8-thread lead screw by setting up a 40 wheel on the mandrel (or cluster stud) and a 30 wheel on the lead screw, any size idler wheels being used on intermediate spindles. The tool should be carefully ground to the correct angle, with a flat point, but should be thinner than the finished width of thread groove, and traversed slightly by the top slide between in-feed cuts. Measure the depth of the thread by the lead screw index if available, but if not, a "witness" diameter may be turned in the clearance spaces, and measured by calipers or micrometer. If the worm-shaft is square with the lead screw, it is immaterial whether the worm is cut left or right hand.

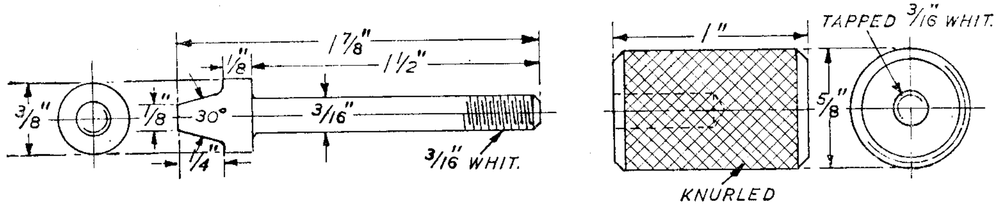


Fig. 7. Details of latch plunger and operating knob

Driving Pulley

Little comment is called for on this component, as it is a perfectly straightforward form of pulley, secured to its shaft by a grub-screw or other convenient means. The countershaft pulley may be made identical with it, except that it must obviously be bored to suit its particular shaft ; but dimensions of either pulleys are not rigidly fixed.

The wormshaft on which the pulley is mounted is simply a piece of bright drawn mild-steel rod ½ in. diam., needing no machining beyond facing the ends and putting on a slight radius or chamfer to prevent burring.

Latch

This consists of the spring plunger and operating knob, the former being turned from mild-steel, screwed at one end $\frac{3}{16}$ in. or 2 B.A. and having a detent or locking tooth formed on the other. It has not been found necessary to provide means of preventing rotation of the plunger, as it finds its own seating quite readily, but if desired, a pointed or spigotted grub-screw can be put horizontally through the bearing bracket to engage in a groove in the side of the plunger.

The operating knob is severely simple in shape, but quite neat and comfortable to operate. However, a more shapely or ornate knob may be fitted if preferred. It should screw fairly stiffly on the end of the plunger and the latter should work freely in its housing. A fairly light spring is quite sufficient to keep the plunger seated in the notch.

After assembling the bearing bracket on the backplate and adjusting the lock-nuts on the stud, so that it will work freely without shake, the notches for the engagement of the plunger may be located. The top one may be approximately on the centre-line as shown, and the lower one sufficiently far away from it to ensure complete disengagement of the worm. The stop pin is fitted for the purpose of preventing the bracket dropping right down, if the plunger should happen to miss the bottom notch.

Jockey Pulley Bracket

As already pointed out, this addition is only necessary when the lathe countershaft is in such a position that a direct run of the belt cannot be obtained. The bracket bolts on to the upper part of the change-wheel quadrant, in such a position as to line up the jockey pulleys with the groove of the wormshaft pulley. Semicircular grooves are turned in the jockey pulleys, which are free to float on their shaft so as to find their own alignment, but are prevented running off at the ends by split pins, circlips or any other convenient retaining devices. The shaft is

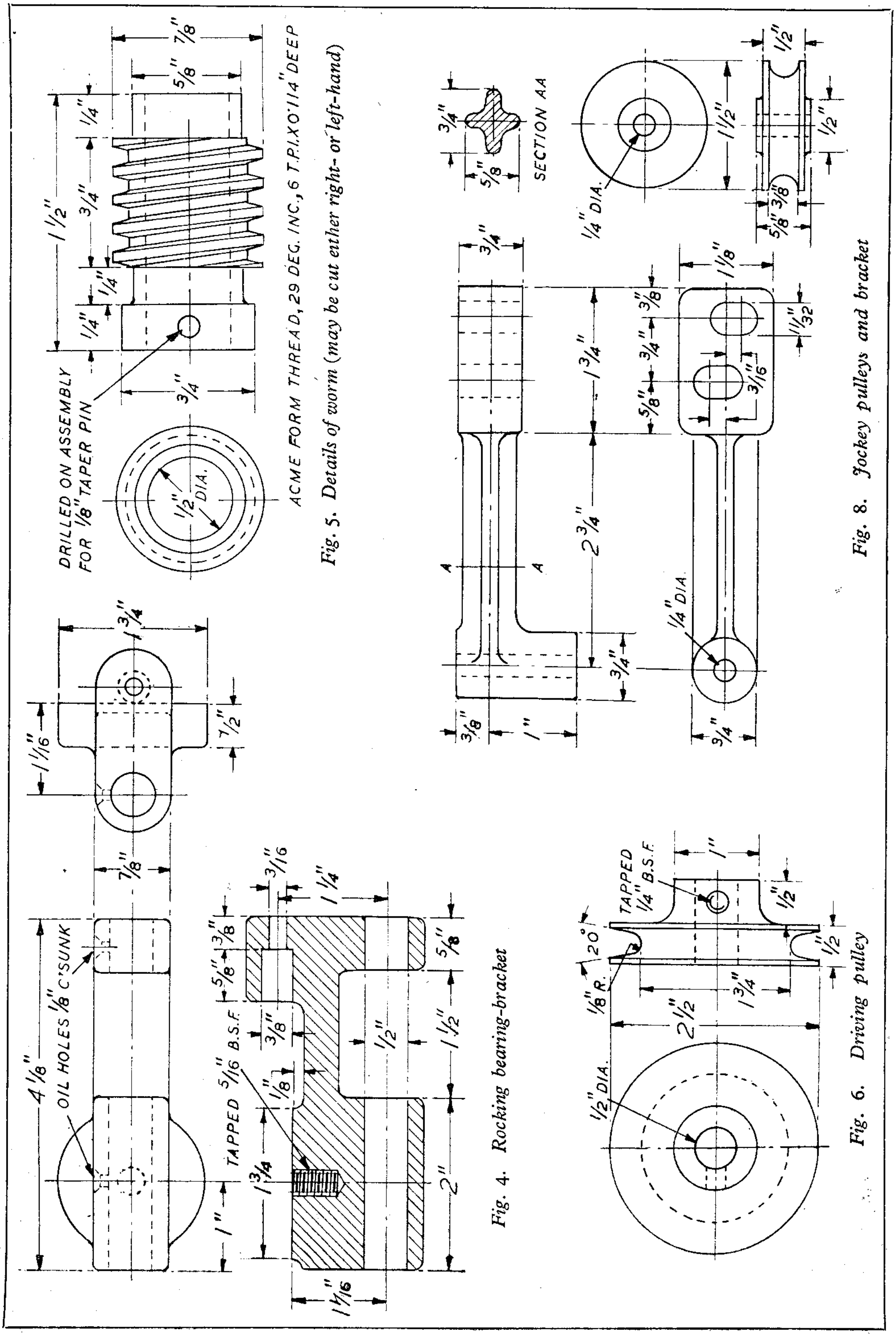


Fig. 5. Details of worm (may be cut either right- or left-hand)

Fig. 8. Jockey pulleys and bracket

Fig. 4. Rocking bearing-bracket

Fig. 6. Driving pulley

simply a piece of ¼-in. diameter mild-steel and need not be firmly fixed in the bracket; the pulleys, if made in cast-iron or gunmetal, need not be bushed and are, of course, a free running fit on the shaft. Details of the shaft and pulleys are given in Fig. 6.

Fitting and Adjustment

When the attachment is set up for use, the bearing bracket should be put in the engaged position, and the backplate is then secured to the back of the quadrant by a single bolt, in such a position that the worm meshes properly with the particular change-wheel selected, when fitted to the lead screw. It will be necessary to fit a smaller change-wheel, or a spacing collar, behind the change-wheel, to locate the latter central with the wormshaft. Having set the worm in engagement, the securing bolt is then tightened. The change-wheel quadrant is then adjusted to bring the pulley groove into fair alignment with the run of the belt, the length of which should be adjusted to suit this position, though minor adjustment of tension can be effected by shifting the quadrant. Note that this does not affect the meshing of the worm.

The self-act can be brought into operation either by the clasp nut or clutch of the lead screw (according to which is fitted), or by the meshing of the worm, the latter being most useful in general work, as it enables the feed to be started instantly at any point, avoiding the delay which is usually entailed in the engagement of a clasp nut or clutch.

If, however, it is necessary to disengage the saddle to run it quickly up to the work or return it to starting point after a cut, by means of the rack feed, the worm may be left in engagement. In practice, one soon gets used to the "dual control," and automatically selects the methods most appropriate to the particular operation.

A minor point in the control of the meshing of the worm is that it is almost impossible for it to be put into action inadvertently, as sometimes happens with a clasp nut or clutch; neither is it likely to jam at the moment it is required to disengage. The idea of adding a "knock-out" device to disengage the gear at any required point in the saddle traverse has been considered, and is fully practicable, but up to the present, no necessity has arisen for this provision.

Rates of Feed Obtainable

The worm can be used to drive any change-wheel having about 30 teeth or over, according to the reduction ratio required, but in the majority of cases it will be found that a wheel of about 50 teeth will serve for general work. Assuming that the pulleys on the countershaft and the wormshaft are of equal size, and that the countershaft speed is 350 r.p.m., the lead screw speed thus obtained (neglecting belt slip), is 7 r.p.m., and the saddle travel, with 8 t.p.i. lead screw, is thus ⅞ in. per minute. At direct-drive mandrel speeds of 175, 350 and 700 r.p.m. respectively, the feeds, in terms of spindle turns per inch travel of the saddle, are 200, 400 and 800; and with back-gear speeds of 30, 60 and 120 r.p.m., the feeds are 33, 66, and 132 turns per inch. All these feeds are obtainable with a single ratio of worm reduction, it should be noted; the examples quoted are not claimed to be taken from actual practice, but are intended only to show the wide range of feeds obtainable.

On one or two occasions it has been found practicable to use the worm-geared self-act while the change-wheels are set up for a screw-cutting operation. The presence of the attachment on the change-wheel quadrant does not interfere with setting up the wheel train; when the self-act is in use, the train is disconnected at the tumbler reverse gear. Of course, the practicability of this arrangement depends on being able to use a change-wheel on the lead screw which is at once correct for cutting the required screw pitch, and equally suitable for the ratio or worm reduction of the self-act.

For the Bookshelf

Model Jet Reaction Engines. By C. E. Bowden. (London: Percival Marshall & Co. Ltd.) Price 3s. 0d.

Jet propulsion for aircraft has come very much into the public eye during recent years, and model engineers were not slow in devising and constructing miniature jet engines which have proved successful. Although still in the preliminary stages of its development, the miniature jet engine has already acquired considerable popularity among model engineers whose interests lie in the study of internal combustion engines. This book surveys, in as simple a manner as possible, the fundamental principles of jet propulsion, and provides the practically-minded reader with a basis on which to develop his ideas. At the same time, the novice will find in it a great deal of useful information presented in a manner that will enable him to understand the rudiments of the subject. The illustrations consist of numerous sketches and diagrams, as well as some photographs of jet engines and their components and a few jet-propelled models.

Toys and Models, by Cyril Pearce. (London: B. T. Batsford Ltd.) 96 pages, size 5¼ in. by 8½ in. Illustrated in line, half-tone and colour. Price 12s. 6d. net.

This delightful book describes and illustrates the construction of many types of toys and simple models, most of them traditional and all of them intended primarily for educational purposes. But their construction, so ably described by the distinguished author, can hardly fail to please the reader, whether he or she be young or old. The illustrations are ideal for their purpose and are beautifully presented; in short, the book is a joy, from cover to cover.

Precision Ball- and Roller-Bearings

by "Don"

THE normal or commercial quality ball- and roller-bearing is an object of great precision, but even this degree of accuracy is not sufficient for a great many of the more exacting applications today.

This point was realised by the manufacturers a considerable time ago and, consequently, two special ranges of bearings were developed.

Precision and Super-precision

These are, in general, to the same nominal overall dimensions as standard bearings, but the limits of inaccuracy are many times smaller. Obviously such ultra-fine limits are expensive and, consequently, these special bearings are supplied only against specific orders, and are rather expensive in comparison to standard bearings.

DIMENSION	SIZE IN M/M	STANDARD	PRECISION	SUPER PRECISION
BORE	0 - 75	+005 m/m -010 m/m	+.0000 m/m -0076 m/m	+.0000 m/m -.0050 m/m
OUTSIDE DIAMETER	0 - 125	+000 m/m -013 m/m	+0000 m/m -0076 m/m	+0000 m/m -0050 m/m

Table I

Table I gives a rough idea of the differences in the tolerances adopted throughout the industry for the various types.

Precision Type

These are divided into two classes :—

Class I is for use in moderate-speed applications where extreme accuracy is required, such as machine tool main spindles. They are normally fitted with bronze-ball separating cages, though sometimes synthetic resin cages are used, particularly where noise must be cut down to a minimum and also where lubrication may not be absolutely perfect. A common application of this type is shown in Fig. 1, which is a lathe headstock. The angular contact-bearings at the work end of the spindle are mounted "back-to-back" and when clamped up endwise as shown, are preloaded, this preload being built into the bearings by the manufacturer and, consequently, when in service the assembly is absolutely rigid with no end float.

Class II is for use on high-speed applications and here again it is essential for extreme accuracy, as the effect of out-of-balance forces at high speed are too well known to be enlarged upon. The bearings are usually fitted with aluminium alloy cages for lightness (the aforesaid centrifugal force) and are usually (though not necessarily) of the same overall dimensions and construction as the extra light series. A typical application is shown in Fig. 2, which illustrates an aircraft supercharger operating at speeds in the order of 30,000 r.p.m. At this speed the balls are revolving at 122,000 r.p.m. (9,950 ft./min.) and the cage is rubbing on the outside diameter of the inner race at 10,550 ft./min.

Super-precision Type

At the present time, these are probably as fine a job as is possible to produce on a commercial scale. Every feature is held to within 0.0001 in.,

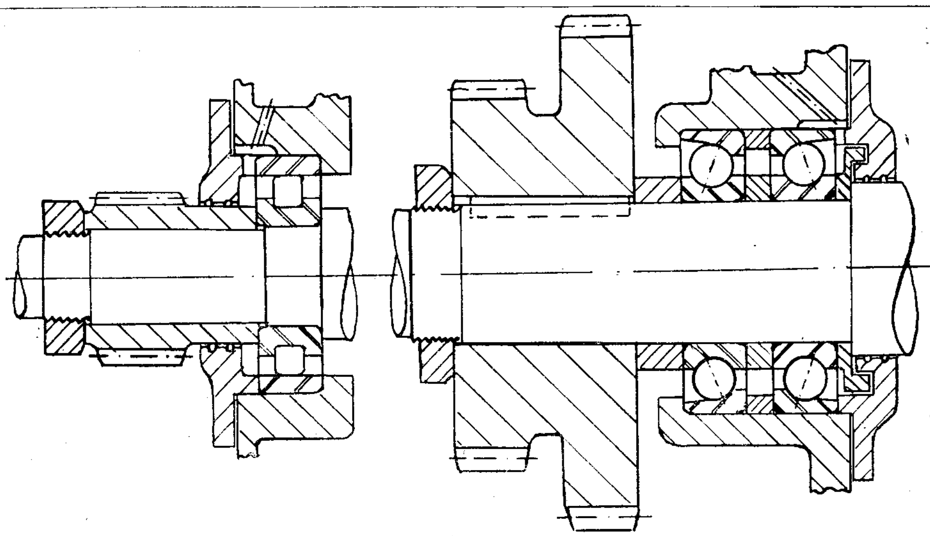


Fig. 1.

this producing a very finely-balanced bearing. They are invariably fitted with synthetic resin cages and are for those applications where high speeds and extreme accuracy are required, such as high-speed grinding spindles, fine borers, etc.

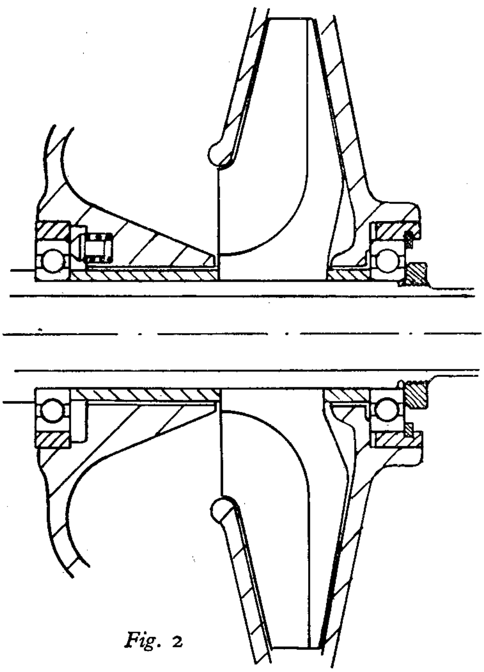


Fig. 2

Fig. 3 shows a typical high-speed internal grinding spindle where the thrust load from the wheel is always in one direction (i.e. towards the drive end). This is resisted by the paired angular contact-bearings at the nose end of the spindle, which are so controlled to share this thrust. The bearings at the tail end of the spindle are mounted in the opposite direction, and, consequently, are not affected by the thrust load, but do take care of the major portion of the journal load from the drive. They are also preloaded by a battery of springs.

Fig. 4 shows a typical high-speed grinding spindle where the thrust may alternate. Here the angular contact-bearings are mounted " back-to-back " at both ends, with inbuilt preload.

The bearings at the nose end are locked endwise in the housing and on the spindle, thus acting as a location unit, the rear bearings being allowed to float.

Fig. 5 illustrates a fine boring spindle. Using a diamond tool, surface finish readings as low as 0.5 micro-inches are being produced on aluminium alloy as a production process.

Lubrication

Two methods of lubrication are shown. In Figs. 1 and 3 the oil is metered to the bearings through wicks by capillary action ; this ensures that the bearings are not flooded with oil, which at very high speeds creates heat due to the churning of the lubricant. Fig. 2 has an oil reservoir, the lubricant having direct access to the bearings, due care being taken that the level is not higher than the centre of the lowest ball. This arrangement being eminently suitable for medium speeds.

Preloading

In the foregoing text mention has been made of preloading. For those readers who are not familiar with this aspect of ball- and roller-bearing technology, I will try to explain it as simply as possible.

In precision machinery of all descriptions, the accuracy depends always on the extremely accurate centring of the revolving parts. To achieve this, all radial and axial clearances must be entirely eliminated. This condition is, of course, impossible with the plain bearing, as certain clearances must be present to avoid seizure. Now the normal type of ball-bearing also has a small amount of internal clearance (though of a much smaller order than plain bearings, as explained in my previous article, THE MODEL ENGINEER, July 10th, 1947) and these may be increased by deflection when under load. The only method, therefore, of eliminating these clearances permanently is by preloading ; this also neutralises the effect of deflection under load.

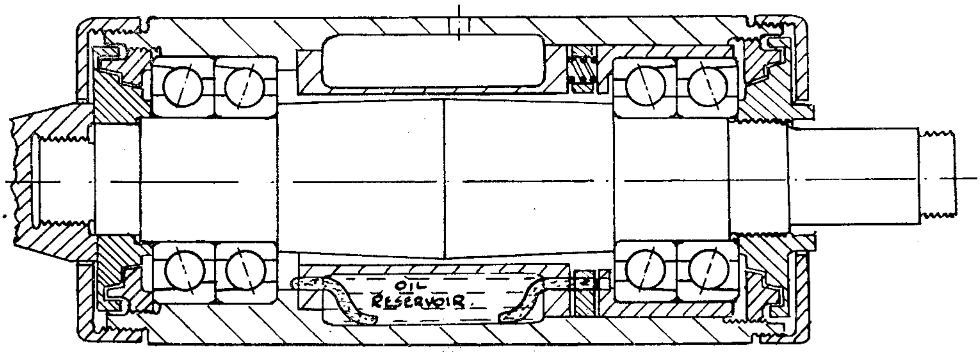


Fig. 3

Simply, then, the main factor in preloading is the removal of all clearances by the application of a load through the bearings which ensures that under all conditions the balls are kept in contact

with the ball tracks, and thus no displacement of the revolving parts can take place due to deflection under load.

Consider for a moment Fig. 6. This shows a pair of angular contact-bearings mounted "back-to-back." It will be seen that the balls are contacting both inner and outer tracks and that, although the inside faces of the outer rings are touching, there is a small gap between the inside faces of the inner rings. When a force is applied at "X," this gap closes and therefore the balls and tracks are compressed very slightly, thus a preload is introduced into the bearings.

The preload required for each application is assessed and translated into terms of gap required from a deflection formula. The gap, in actual fact, may vary from as little as 0.0005 in. to a maximum of 0.004 in. Care must be exercised on large gaps, so that actual indentation of the tracks does not occur which would lead to very rough running of the bearings.

For angular contact-bearings mounted "face-to-back," as shown in Fig. 7, an external load is required to give the requisite preload, and a battery of springs forms a very convenient method. First-quality springs with accurately ground flat ends are used, and since the compression rate is known, the amount of preload is determined by the number of springs used and the amount that these are compressed.

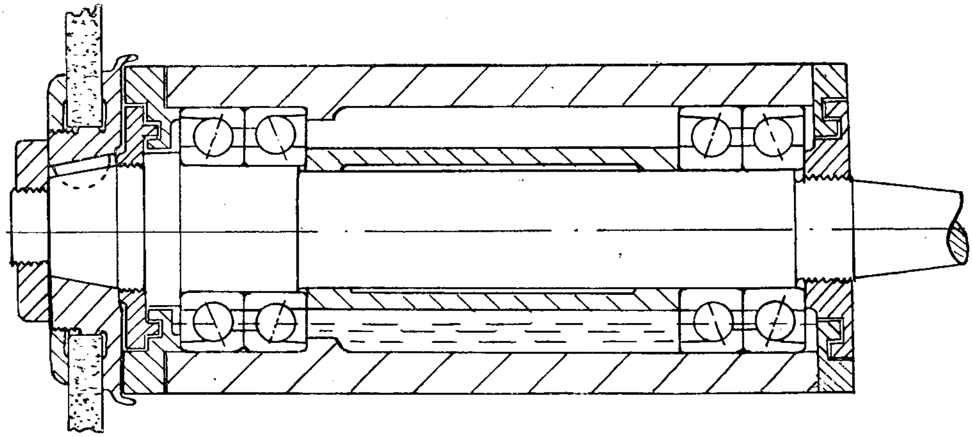


Fig. 4

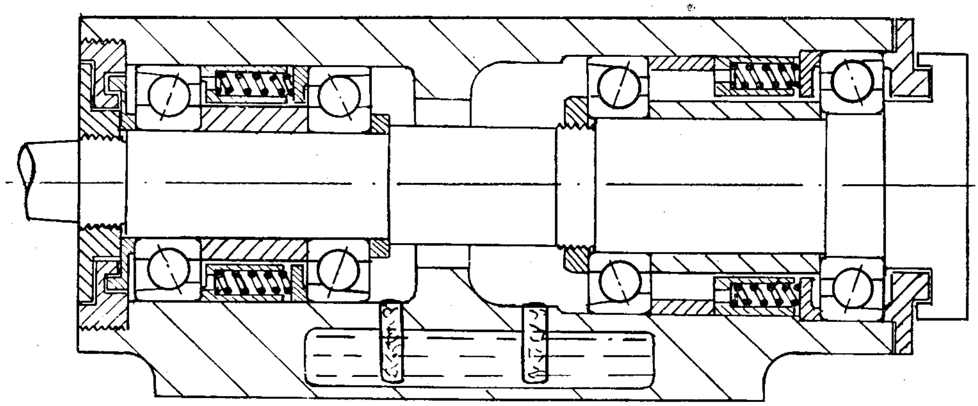


Fig. 5

In conclusion, I would like to pass a few remarks with reference to the controversy that has raged in the correspondence columns recently on the question of anti-friction bearings versus plain bearings for machine tool main spindles and similar exacting applications.

In the first place, plain bearings, be they parallel or taper, steel or phosphor-bronze, must have an adequate working clearance. If this is reduced below the safety figure, overheating and seizure under high speeds and heavy loads is liable to occur, since there is a relatively large area of contact between the shaft and the bore and the bearing, which must always be adequately lubricated. Obviously, then, the shaft is free to float radially in the bearing within the limits of this clearance, and, consequently, this movement is reflected in the finish produced and also in the lack of roundness of the work. (I would add here that, when fine finishes are involved, the eye is not a very good judge and the usual standard adopted is the degree of roughness measured in

micro-inches, which is measured by surface roughness measuring instruments such as the "Talysurf.")

On the other hand, a ball-bearing arrangement as shown in Fig. 1, utilising two angular contact-bearings mounted back-to-back, with preload, has no internal clearance and, consequently, the shaft revolves perfectly central within extremely fine limits and with no rise and fall. (I would emphasise at this point that standard bearings are not suitable for the work in question, and I am referrring to precision or super-precision types only.)

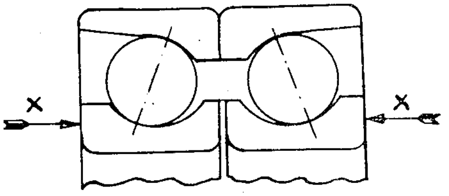


Fig. 6

This arrangement has been applied, not only to ordinary centre lathes of all sizes, but also to multiple-spindle automatics over a long period, and has proved very successful.

Another point that must be considered in a general comparison is the question of the power absorbed by the bearings. It is a well-known fact that the coefficient of friction of a plain bearing is somewhere around 0.010, that of a ball-bearing is generally accepted as 0.001 and of a roller-bearing 0.002.

Whilst admitting that this may not be a very important matter on large machines where the power available is usually in excess of the maximum required, it is of far greater moment where only fractional horsepower motors or the power produced by the leg, *via* a treadle, is available.

Finally, an article by Mr. J. Boneham which was published in *Machinery* some time ago included some very interesting "Talysurf" graphs, which showed the comparative finishes produced by (*a*) a plain bearing and (*b*) a ball-bearing spindle. This proved beyond all reasonable doubt the superiority of the ball-bearing spindle.

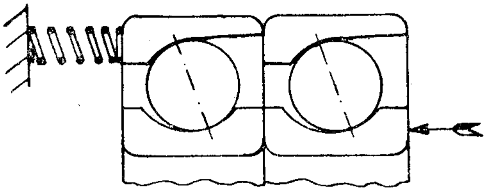


Fig. 7

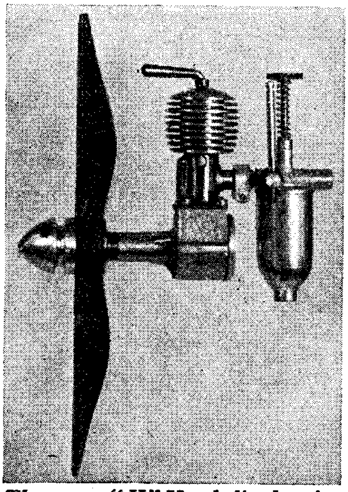
This, I think, adequately covers the case for the ball-bearing. I have not dealt with taper roller-bearings for the very good reason that this was amply covered some weeks ago by Mr. Doughty, of British Timken, an acknowledged expert in that particular field.

Small Diesel Engines

THE "K" Model Engineering Co. Ltd., of Darnley Street, Gravesend, Kent, are to be congratulated on successfully producing a diesel engine of only 0.2 c.c. and weighing 1 oz. complete. Smaller engines have been made by model engineers, but commercial production on a large scale is quite a different proposition.

The 0.2 c.c. "K" Hawk engine will by virtue of its tiny size appeal particularly to those with a liking for miniature models. It is a thoroughly practical power unit for small lightweight model aircraft up to 24 in. in wing span.

On test, 5,500 r.p.m. were obtained with the 4-in. diameter propeller supplied by the makers. Starting from cold is made quite easy by the provision of a spinner with a cord groove, and once the engine is warm it can be started without difficulty by flicking the propeller over compression by hand in the normal manner.



The 0.2 c.c. "K" Hawk diesel engine

The engine is less tricky to operate than many larger diesel engines that we have tested, and the throttle and compression adjustments are not as critical as one would expect in so small an engine. For example, although the makers recommend a fuel mixture consisting of ether 35 per cent., paraffin or diesel oil 35 per cent., lubricating oil 20 per cent. and castor oil 10 per cent., the engine functioned equally well on three other mixtures.

A filler orifice would obviate the necessity for unscrewing and removing the tank for refuelling purposes, but this is a minor point which can easily be overcome.

The finish of the engine is very good, and at the price of £4 7s. 6d. it represents good value.

*A Boring-Head for the Lathe

by Arnold Thorpe, M.I.Mech.E.

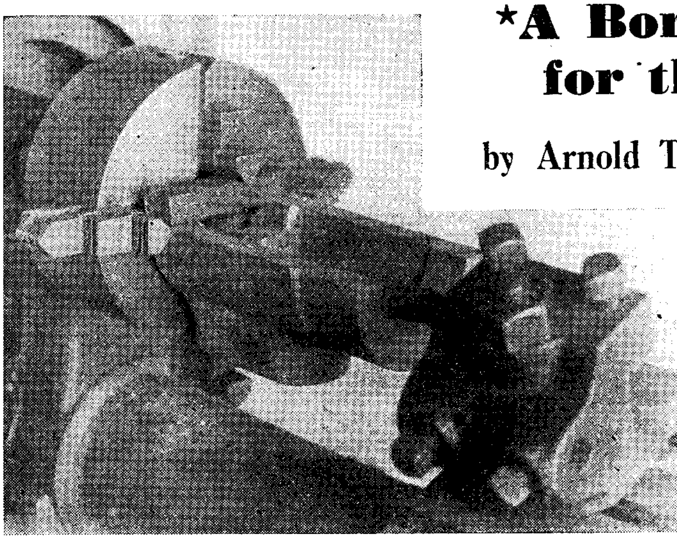


Photo No. 3. Boring saddle-piece —first setting

PHOTO No. 3 shows how the first boring operation was tackled. Gripped in the chuck with a stout packing bridging the U, the end remote from the nut was faced, and the outside turned true for a length of about 1 in. No special dimension was aimed at, but enough cuts were taken to remove the rough surface and leave a parallel portion. The inside bearing surface was now bored, using the slide as the gauge for size. The boring was made the last operation in case of anything shifting in the chuck. Had that occurred, the end or the outside, being of no special size, could have been trued up again; but with the finished bore, that would have been impossible without making it larger than the slide, and thereby spoiling it.

The casting was then removed from the chuck and mounted on the faceplate as shown in Photo No. 4, using two long bolts with large nuts. Hardwood packings were cut exactly to the right length to go behind the nuts and kept well to the outer sides, so as to get as much pressure as possible on the casting, when the bolt heads were turned with a spanner behind the faceplate. It will be noted that the end of the casting now resting against the faceplate is the end machined true with the bore. The saddle casting was set by sliding it about on the faceplate until the outer turned surface was truly concentric, as tested by the scribing block at three points. The scribing block was moved about on the boring table for this test so that it could be kept clear of the bolts and packings whilst rotating the spindle by hand from one position to another. Finally, the inside was bored and proved true with the previously bored surface at the other end. Size was obtained again by using the slide portion as a gauge. After removing from the lathe, a very slight attention with a half-round scraper made the two parts slide smoothly together.

The saddle and slide are held together by two straps of 1 in. × $\frac{1}{8}$ in. bright mild-steel, each strap secured to the saddle by one $\frac{1}{4}$ in. countersunk screw at each end. Provision was made for a $\frac{5}{8}$-in. diam. boring-bar with inserted

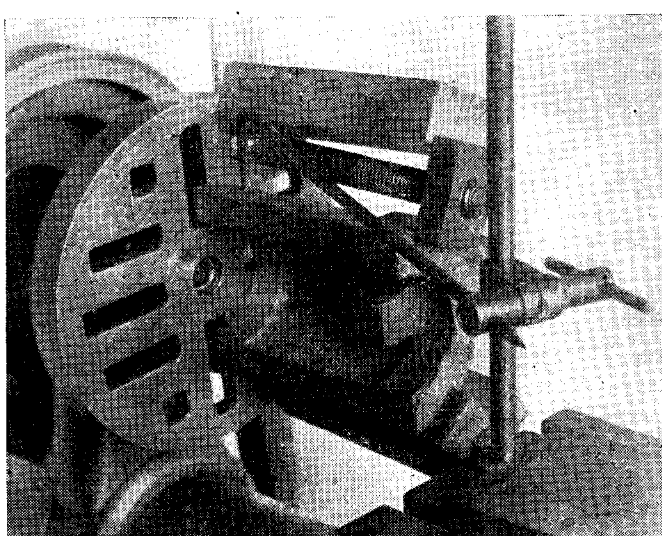


Photo No. 4. Boring saddle-piece—second setting

*Continued from page 96, "M.E.," July 22, 1948.

cutter bit $\frac{3}{16}$ in. diameter to be set in any of three holes in the saddle. The movement of the saddle is $1\frac{1}{2}$ in., and the area which can be reached by the cutter is shown in the drawings. It will be seen that without the cutter projecting from the bar to any extent, the maximum size hole which can be bored is $6\frac{5}{8}$ in., and any hole up to this size can be dealt with by placing the bar in one hole or another. With the bar in the outermost hole and the cutter turned inwards, a male spigot or register can be turned with a diameter of $5\frac{3}{8}$ in. It is essential to have a stout rigid bar, hence the $\frac{5}{8}$-in. diam. selected. Various lengths of bar can be used, of course, and one can have bars with the cutter holes square with the axis for boring, and at 45 deg. for facing cuts.

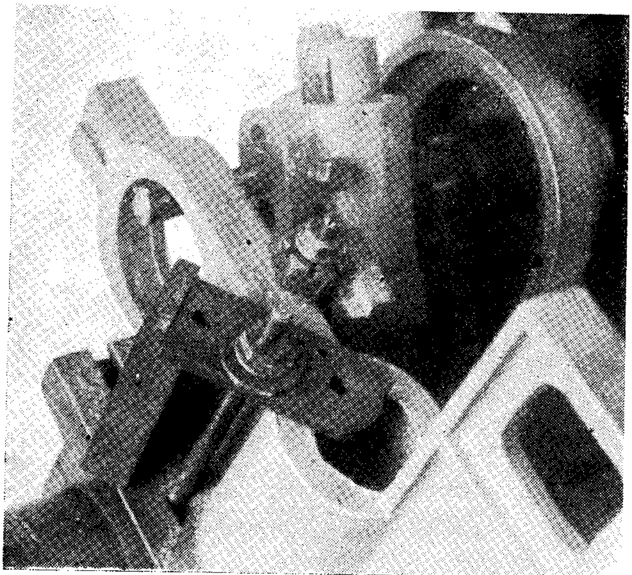


Photo No. 5. Finished tool in use. Boring and chambering 3 in. diameter hole in cast-iron bracket

Conclusion

The appliance has given every satisfaction in use. It might perhaps be criticised on the grounds of being unduly heavy and bulky for a small lathe. Metal is cheap and many tools fail through not having sufficient mass in them to prevent deflection and to absorb vibration. This head is not intended to rotate at high speed, so that out-of-balance effects are of no consequence. When using the head for facing, it is necessary to get down to a very slow speed in order to be able to catch the pin in the head of the actuating screw each time it comes round and put on the little bit of cut each time. It would be an advantage to replace this pin with a star wheel of say 6 points, and have a striker to fix on the lathe bed for moving it one tooth at each revolution. This was formerly a common method of tool feeding on large machine tools used for cylinder boring and for pipe facing. However, this refinement can wait until pressure of other work permits its inclusion.

The Boring-head at Work

Unfortunately, it has not been possible to take photographs of every job done by this boring-head, but two are available which show it at work. Photo No. 5 depicts the boring of a short hole, 1 in. long by 3 in. diam., in a cast-iron bracket which was part of a drilling machine. Back-gear was used for this and after boring through, a chamber was made for half the length of the bore by out-feeding the tool whilst in motion, and then traversing the necessary length at the new diameter. This was done to ensure that the bracket, when clamped on a 3-in. diam., cylinder would not rock on the very short bore. Photo No. 6 shows the boring of a hole $1\frac{5}{8}$ in. diam., by $3\frac{3}{4}$ in. long in a gunmetal casting. This job was done on slow speed without back-gear, and a very good hole free from chatter marks obtained, in spite of the fact that at one part the cut is interrupted by the side-hole breaking in. During the war the factory to which the unit was loaned bored many holes in cast-iron for ball-bearings $3\frac{3}{4}$ in. diam., and found the radial feed just the thing for cutting the grooves for the Seeger circlips with which the bearings were located.

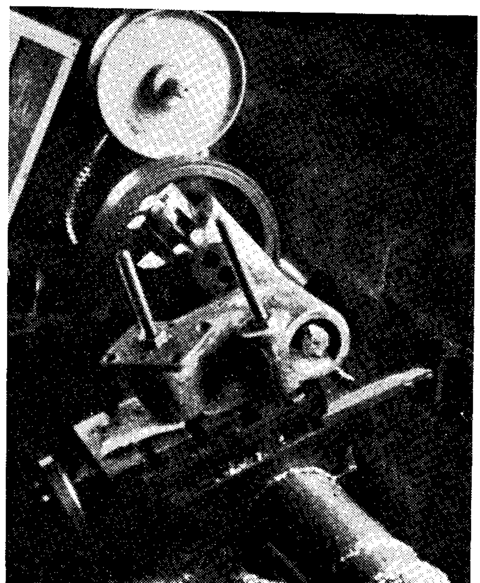


Photo No. 6. Another boring job : $1\frac{5}{8}$ in. diameter hole $3\frac{1}{4}$ in. long in gunmetal

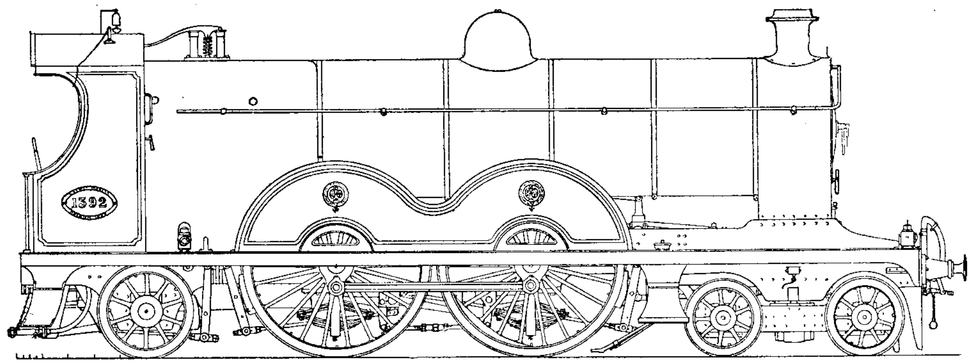
Locomotives Worth Modelling

by F. C. Hambleton

No. 27—L. & Y. Railway, No. 1392

UP to the turn of the present century the standard express passenger locomotive had been of the 4-4-0 type. But heavier bogie coaching stock and the development of the corridor carriage made more power imperative, and, very naturally, an increase in the dimensions of the boiler appeared to be the solution of the problem. But how to increase the length, both of barrel and firebox when the length of the wheelbase was already approaching its limits? Dugald Drummond was bold enough to employ a 10-ft. coupling-rod in order to accommodate a long 7-ft. 4-in. firebox on his "706" class that he designed for the London & South Western Railway, whilst J. F. McIntosh had tried a really large boiler barrel on the Caledonian *Dunalastair* type. The answer to these problems came from the other side of the Atlantic. In 1895, Mr. W. P. Henszey designed some locomotives for the Philadelphia & Reading Railroad, which quickly became famous for the high-speed performances on daily runs between Camden and Atlantic City; at that time, these were the fastest expresses in the world. Mr. H. A. Ivatt, at Doncaster, in 1898, took the first step by introducing this "Atlantic" design into this country, and No. 990 created quite a furore amongst locomotive engineers. The planning of this type of engine was as simple as it was effective. By drawing the two pairs of 6-ft. 7½-in. driving wheels closely together with a wheelbase of only 6 ft. 10 in., and adopting the "contractors' engine" layout of connecting and coupling rods, the frames could be extended backwards as far as need be to take a pair of 3-ft. 7½-in. carrying wheels. Thus it was possible to accommodate a boiler barrel as long as 14 ft. 8½ in., and an 8-ft. firebox!

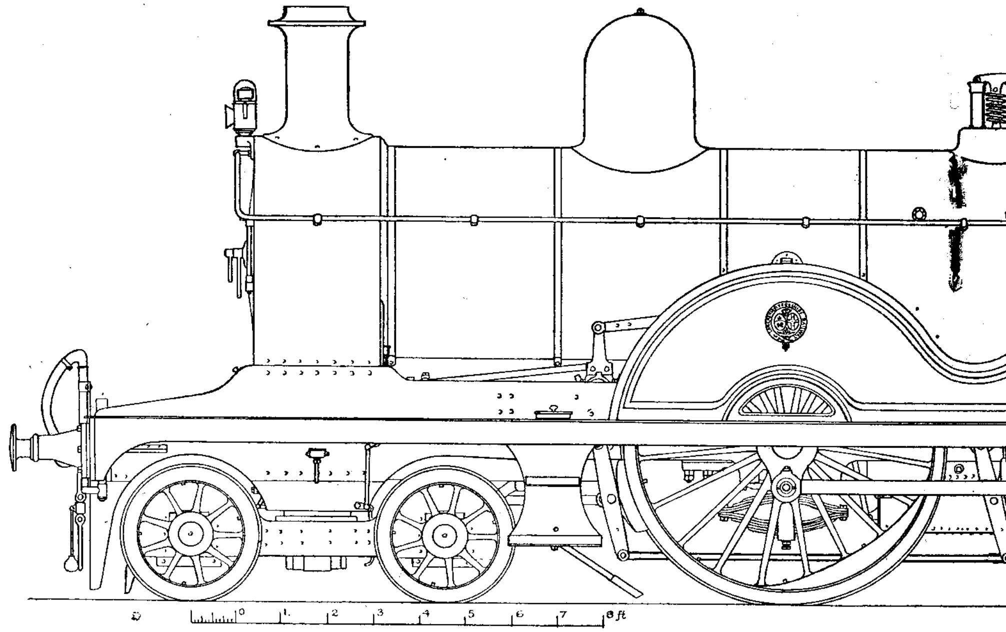
The Lancashire & Yorkshire Railway was the next one to follow suit. But Mr. John Aspinall was averse to outside cylinders; so he designed what was, in reality, an expansion of his celebrated and highly successful 4-4-0 express engine of the 1093 class, and in March, 1899, Horwich Works gave the locomotive world a real thrill when the monster inside-cylindered Atlantic, No. 1400, left the famous works. She was a huge engine indeed, but the very simplicity of her exterior appearance gave her an interest and grace not easily forgotten. Her black paint was relieved by a splendid band of shining brass around her two-in-one splashers, and the two other notable spots of colour were her polished brass numberplate with its black background, and the bright steel valve levers of the Joy gear plainly visible, as they rose and fell beneath the enormous boiler barrel.



The mighty "Speed King" of the L. & Y. Railway

Forty of these splendid engines were built to the original design. They were all lined-in in standard L. & Y. fashion. That is to say, they carried a broad red line, its inner side bearing a marginal white line, and inside this again was placed a second fine white line. The frames were black, and the buffer beam was vermilion, edged with a black border and fine inner white line touching it. The small standard tender with its water scoop arrangements was adorned with simple initials in gold-leaf.

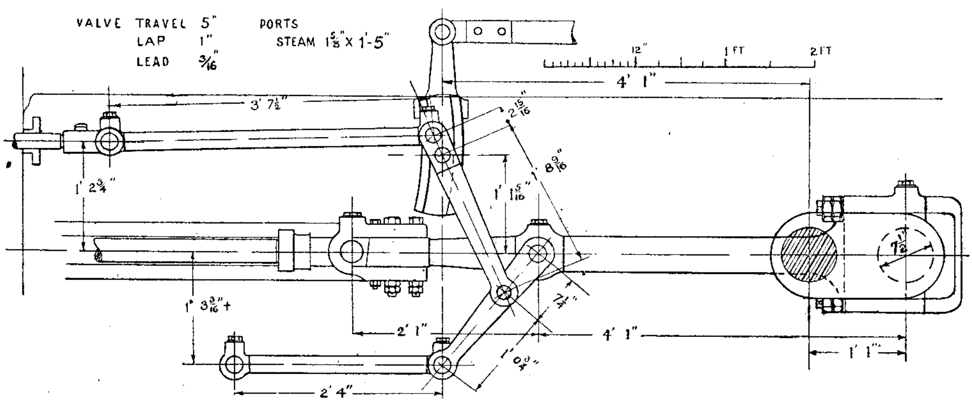
I shall never forget the first time I saw No. 1400 standing at York station. This lovely monster seemed to dwarf every other engine in the neighbourhood, for it must be remembered that she was indeed the forerunner of all the modern giants. Even the handsome North Eastern Railway "R" class, painted in their wonderful green livery, and by no means small locomotives, appeared suddenly to shrink somewhat in size! It was a thrilling experience to see the famous No. 1400 herself, and when, later, No. 1392 steamed into view, one felt very satisfied indeed.



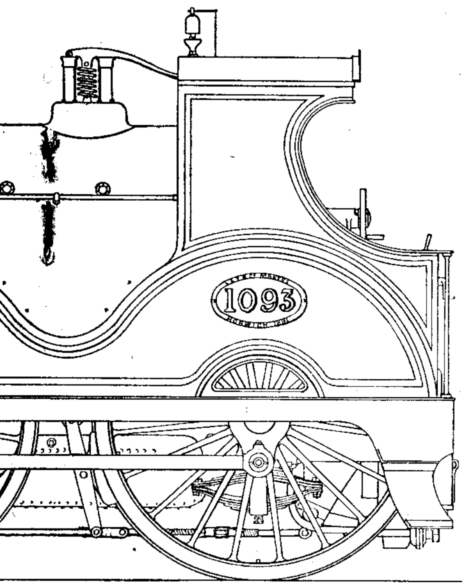
Aspinall's No. 1093 *was the ancestor of the mighty* 1392

This engine, so it was said, was a real flyer, for on July 15th, 1899, when working between Liverpool and Southport, she had covered the first 17 miles from Liverpool in 12 min. 45 sec., (a start to pass average of about 80 m.p.h.) and also, it was claimed, had reached 100 m.p.h. at one particular point! We are all aware of the difficulties of accurate timing at high speeds, but, in any case, a performance approaching such figures was obviously a marvellous one. No wonder the men called these giants "High-flyers!"

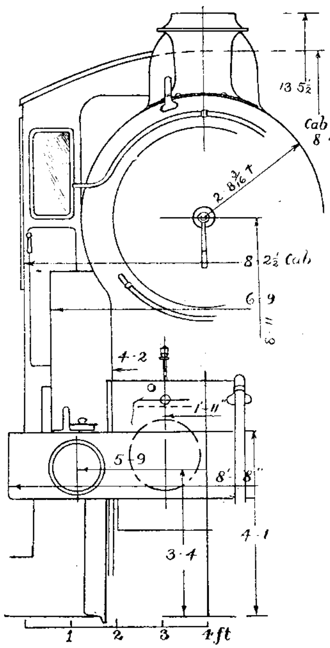
Their big 19 by 26 in. steam-jacketed cylinders, with steam ports $1\frac{5}{8}$ by 17 in., and a clear exhaust port straight up through a cavity in the crown of the balanced slide-valve, together with large 7-ft. 3-in. driving wheels and lots of steam at 175 lb., made all these remarkable doings possible. The standard L. & Y. motion was fitted, except that a new form of coupling-rod big-end was introduced, resembling somewhat the Drummond L.S.W.Rly. pattern. The crank axle had a central bearing, 7 in. in diameter by $9\frac{1}{2}$ in. length, the box of which rested in a central stay



Joy's valve-gear as fitted to L. & Y. Railway locomotive No. 1392



) 1392

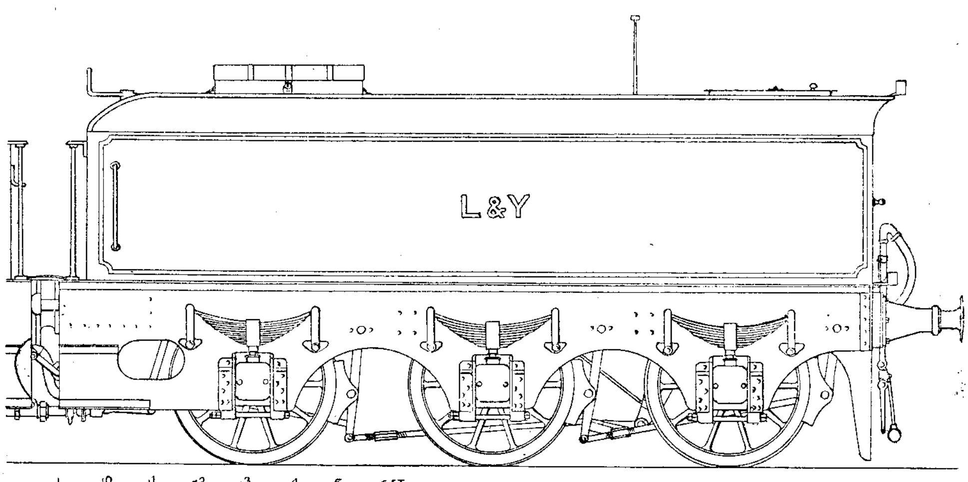


Note the cab door and the picturesque chimney

extending from the motion-plate to a stretcher-plate which was 1 ft. $9\frac{3}{4}$ in. behind the centre of the axle. The driving wheel axleboxes were compensated, large angles being connected by a central rod, the angles bearing down on the upper of a pair of opposed laminated springs. There was plenty of braking power, a vacuum cylinder actuating the four driving wheel brake blocks, whilst another cylinder was provided for the rear carrying wheel blocks.

The boiler tube-plate was a circular flanged one, $\frac{7}{8}$ in. thick and was placed well within the boiler barrel, being no less than 3 ft. $10\frac{5}{8}$ in. from the centre-line of the $5\frac{1}{2}$-in. blast pipe. The regulator valve was a balanced double-beat one, actuated by a handle placed on the side of the Belpaire firebox, as in the later Gresley

(*Continued on page* 124)



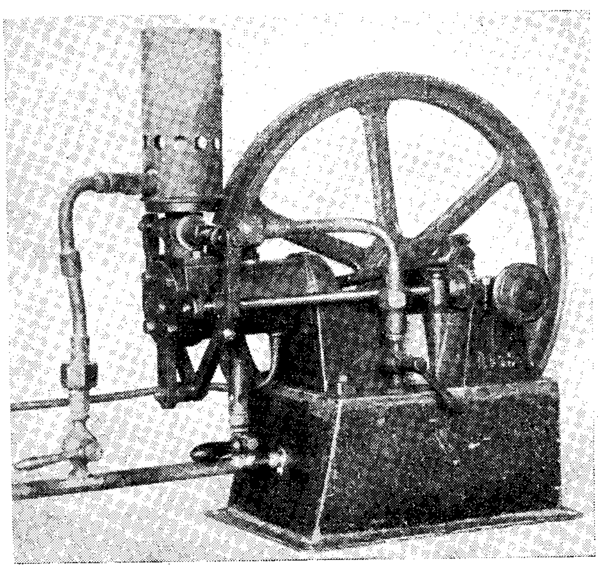
This tender followed on the giant 1392 to perfection

A Small Gas Engine

by J. L. Mayhook

THE gas engine here described, although not of great antiquity, has sufficient age to deserve a certain respect. It has the added interest of being a commercial example of early small-scale i.c. engine practice—and this at a time when the seriousness of the challenge of the internal combustion engine was only beginning to be appreciated.

The history of the engine, as far as I know it, is that in the early days of Meccano, a demonstration of working models was displayed by a Liverpool shop, the models being driven by this engine. This would be in about 1908. (Meccano Ltd. have been unable to trace any record of this engine.) Since then, the engine has been in private ownership, being brought forth on special occasions to entertain the younger generation.



Discernible on the side of the engine bed is the painted number " No. 73 " ; at the front of the bed there is a pressed brass plate bearing the legend " Made in Germany," the initials " E.P." and a wings-and-wheel device.

From the illustration is will be seen that the water-jacketed cylinder is entirely conventional, and is cast in one with the bed : the bore and stroke are approximately $\frac{7}{8}$ in. and 1 in. The provision of a small bunsen burner under the water jacket is rather interesting, and is presumably for warming-up prior to starting—a hint of starting difficulties ? The cylinder-head is detachable, and carries extensions for a camshaft bearing, and for the rocker-yoke pivot. A detachable cast-iron valve box is also provided ; surmounting the valve box is an asbestos-lined casing surrounding the porcelain ignition tube ; another miniature bunsen burner is arranged to heat this tube. Brass valve-housings are screwed into the valve-box casting, and the brass valves have a triangular stem, and a $\frac{3}{8}$ in. diameter head, the gas flow being in the spaces between the triangular stem and the circular bore of the valve guide. The inlet valve comprises two valves on the one stem, the smaller valve being for gas admission ; there is a small air intake hole in the valve housing on the engine side of the gas-valve seating. The gas-air mixture is then admitted by the $\frac{3}{8}$-in. diameter valve. Gas is supplied by way of the copper pipe and plug cock from the box bed of the engine ; this box bed is—rather unusually—made from sheet zinc. Gas flow in both the inlet and exhaust valve passages is somewhat restricted, perhaps a deliberate feature to prevent the engine from racing.

The valves are operated by a cast-iron yoke with adjustable tappets at the extremities. The yoke is oscillated by a double-lift hardened cam, cross-pinned to the camshaft, which is driven by brass bevel gears. During the portion of the cycle when the exhaust valve is being opened, there is a very heavy load on the cam, caused not only by the compression of the exhaust valve spring, but also by compression of a spring attached to the yoke, which later in the cycle must compress the inlet-valve spring. The action of this dual load on the return face of the cam permits the load momentarily to take charge of the timing gears, and at this point of engagement the bevel teeth are badly worn.

The cast-iron piston is $1\frac{1}{4}$ in. long, and has three oil grooves ; there is no provision for a piston ring. The crankshaft is apparently a forging, the shaft portion being about $\frac{5}{16}$ in. diameter, machined to 0.247 in. diameter at the timing-gear journal, 0.287 in. diameter at the flywheel journal, and 0.279 in. diameter crankpin. Distance between the main bearings is about $2\frac{3}{4}$ in.—rather a long way. The flywheel is quite an imposing affair, being 8 in. diameter, and 13/32 in. wide, the rim being nickel plated.

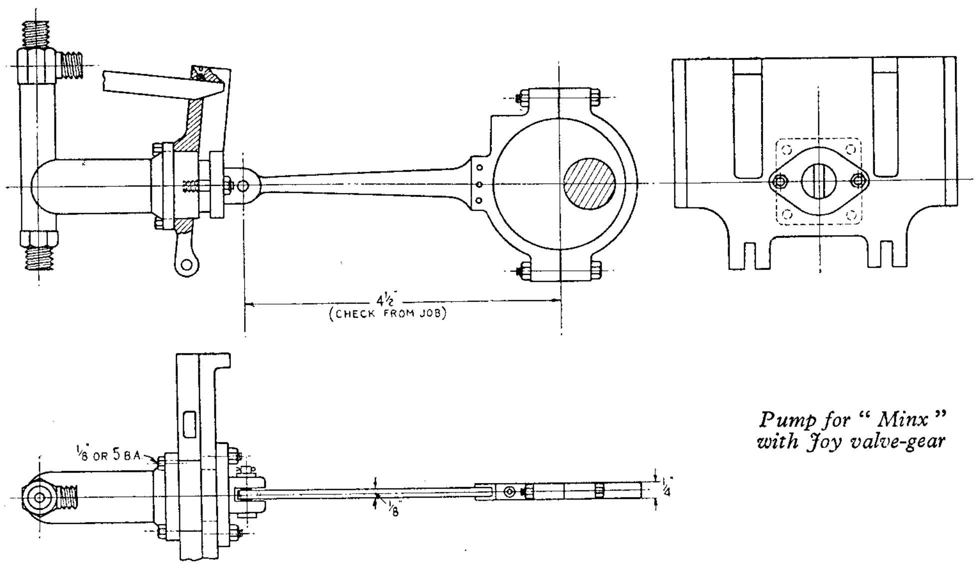
The engine is normally mounted on a wooden baseboard (removed for photographic purposes), which carries a zinc tank as part of the thermosyphon cooling system, also a silencer and exhaust pipe.

Using electrical ignition, the engine has recently been run under its own power ; it was easy to start, and ran smoothly and quietly—except for the high loading spot of the bevel gears, which caused a click at each revolution of the camshaft.

Pump for the Joy-Geared "Minx"

by "L.B.S.C."

THANK goodness for small mercies! This is the last of the bluepencil feed-pumps—eh, what's that? I haven't described one for the outside-cylinder engine? Your mistake; this one will come in nicely. All you do, is to mount it on a plain cross stay between the frames; I'll give the exact location when describing the valve-gear for the outside-cylinder engine. Having settled that merry "heckler," the pump for a "Minx" with Joy valve-gear was an easy job compared with that for a link-motion "Maid of Kent." There was plenty of room for a pump barrel and valve-box between the two crossheads, and no obstruction between the two sets of valve-gear mounted on the connecting-rods; and as my little 4-4-0 "Sybil" has Joy valve-gear, and a pump attached to the motion-plate, I visualised and then set out a similar arrangement for the "Minx." Incidentally, my pet way of doing these jobs is to pin a sheet of tracing paper over the main drawing (in this case the plan and elevation of the "Minx's" Joy valve-gear) and lay out my idea on it, as this enables me to spot in a jiffy if any part is going to run foul of any other part. By using separate bits of tracing paper, I don't get my original sheet so jumbled up with hieroglyphics that it takes the proverbial month of Sundays to sort out.



Pump for "Minx" with Joy valve-gear

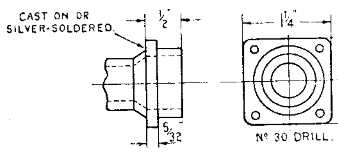
The pump itself is practically the same as described for the "Maid of Kent," the only difference being in the fixing, no side wings being needed. The oval flange on the end of the stuffing-box is dispensed with, and the end of the stuffing-box turned circular, 1 in. diameter, to fit the hole in the motion-plate. At the barrel end of the stuffing-box, a flange is needed, $1\frac{1}{4}$ in. square, with rounded corners; this may either be cast on, if our advertisers are willing to oblige, or made from a piece of $\frac{1}{8}$-in. or 5/32-in. brass plate cut to shape, drilled a tight fit for the stuffing-box, and silver-soldered in place. If you try to braze it, you'll probably melt the casting, the plate, or both. A No. 30 hole is drilled in each corner of the flange, to take $\frac{1}{8}$-in. or 5-B.A. screws for attaching the whole bag of tricks to the motion-plate.

Fitting and Erecting Details

The machining of the valve-box, fitting valves, and making caps and unions, also boring the barrel and fitting ram and gland, are exactly as described for the "Maid's" pump, so we need not go over all the ritual again. When you have waded through the various operations, remove the motion-plate if you have already erected it (very few builders will have made the complete Joy gear and erected it in a week, or I miss my guess!) and insert the end of the stuffing-box in the 1-in. hole drilled through the rectangular boss in the middle of same. This hole should be drilled at right-angles to the face of the boss, *not* the plate itself, as the pump is horizontal, whilst the motion-plate is inclined. Adjust the valve-box so that it is "straight up and down" with the motion-plate; then clamp the flange to the plate temporarily, run the No. 30 drill through the holes, making countersinks in the rectangular boss on the plate, remove pump, drill the counter-

sinks No. 40, and tap $\frac{1}{8}$ in. or 5-B.A. Replace pump and secure by a screw in each corner; I have shown hexagon heads, but any will do, as the pump is out of sight of Inspector Meticulous.

Without any packing in the stuffing-box, put the gland in place, and push it right home until the oval flange comes up against the motion-plate, then adjust until the flange is horizontal. Put the No. 21 drill through the stud holes and make countersinks on the motion-plate, then follow up with No. 30, and note, this drill should go in so that the studs will be horizontal, when the motion-plate is in position on the engine. They cannot be put in at right-angles to the plate,



Detail of pump flange

otherwise they won't go through the holes in the flange. The easiest way for a beginner to drill the holes correctly, is to leave the gland in place, and use the stud holes in it for a guide, seeing that the No. 30 drill is square in the centre of the stud hole when drilling. Also when tapping with 5/32-in. by 40 tap, the No. 21 holes in the flange will guide the tap in at the correct angle, so that the studs should screw in ditto. However, if any beginner does make a slip, there is no harm done; merely bend the studs to the correct angle, so that the gland slides easily over them. The studs are the same as those on the "Maid"; and the ram can then be fitted, the gland packed, and the complete unit erected in the frame.

Drive and Adjustment

The eccentric-strap and rod are machined and fitted in the same way as those described for the valve-gear of the engine with link-motion, but the strap is made $\frac{1}{4}$ in. wide, to suit the slightly wider single eccentric specified for engines with Joy valve-gear. The slot in the pump ram may be cut 5/32 in. or even $\frac{3}{16}$ in. wide if desired, so as to get a longer bush in the tail of the eccentric-rod, and give extra resistance to wear. Leave the eye end about $\frac{1}{2}$ in. diameter for a kick-off; then put the eccentric strap and rod in place, and have the eccentric on front dead centre as shown in the illustration. Push the pump ram right home, and enter the end of the eccentric-rod in slot in same. Mark position of the wrist-pin hole on the eccentric-rod, with a bent scriber poked through the crosshole in the ram. Take off the eccentric-strap and rod, make a centre-pop a little over 1/32 in. nearer the strap, than indicated by the scriber mark. Drill it out with 7/32-in. drill, then file the eye to $\frac{3}{8}$ in. diameter. Fit a bronze bush to the hole, drilled No. 23 and reamed 5/32 in. and let it project a weeny bit each side, so as to run in the slot in the ram with no appreciable side play. The gudgeon-pin, or wrist-pin, can either be a turned flat-headed pin secured by a washer and split pin as shown, or a bit of 5/32-in. rustless steel can be used, turned down to 7/64 in. each end screwed 6-B.A., and furnished with 6-B.A. nuts. Brass nuts are best, both for this and the studs holding the gland, as a few drops of water usually manage to work past the packing, and steel nuts on a pump always try to rust up unless they are smothered with oil.

Milly on the Lickey

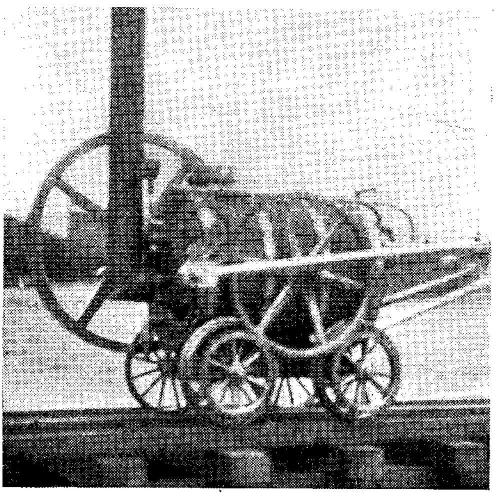
On page 637 of June 17th issue, there is another instance of the folly of jumping to conclusions. "J.N.M." is quite right; Mr. A. P. Goodman is hopelessly wrong is assuming that I meant a "self-contained" outfit when I suggested the electrification of Bromsgrove Lickey. I happen to know more about electric traction than might be expected of such an ardent devotee of steam, and could describe how to build a passenger-hauling $3\frac{1}{2}$-in. gauge electric locomotive, or a motor-coach for a multiple-unit set, in full detail, on "full-size" lines, had I the time, inclination, and approval of our friend the K.B.P.

Within a stone's throw of where I am sitting at this minute, time of writing, there is an unattended transformer station; not only that, but it doesn't have even any walls or roof! On the London "Underground" lines, there are several fully-equipped sub-stations that can do their job 24 hours per day if necessary, without human aid and without making any mistake. There is a "grid" line not so very far away from the Lickey, although it wouldn't matter much if there weren't, seeing that a fault in a grid line near Norwich recently spoilt Sunday dinners in Kent and Sussex, and "juice" can travel from here to Australia in about one-seventh of a second, very nearly as quick as the "Brighton Belle."

Soon after we returned from "evacueeing" in 1944, I was talking to an official who has had a great deal to do with the electrification on the Southern, and asked him about the Lickey job, suggesting that an automatic transformer and "sub," plus third-rail or overhead wire on both up and down lines, a siding each end, the necessary crossovers, two three-unit "Milly-Amp" locomotives, and a shed for same, would do the job. Current to be supplied from the Birmingham or other grid line that happened to be most convenient. He said it would not only be perfectly satisfactory in operation, but an economic proposition as well, the operating cost being extremely low, and the installation cost not so very great, either. The electric locomotives would need no attention whatever when standing between trips, and he also mentioned another advantage which I hadn't thought of at the time, namely, that the engines could be attached to trains *coming down* the bank, as well as going up, and in certain conditions control them by regenerative braking; thus not only returning "juice" to the third-rail or trolley wire, but saving wear and tear on brake shoes and wheel tyres.

I agree with "J.N.M." that the best alternative to the steam locomotive for main-line work on runs of 100 miles or more, at infrequent intervals, is a self-contained unit—in effect, an electric locomotive carrying its own power station; but it seems to me a rum sort of idea to cast aside a well-tried, simple, faithful and efficient servant,

using home-produced fuel, for a complicated box of tricks like a diesel-electric. Their thermal efficiency may be higher, true enough; but to my way of thinking—maybe an old-fashioned one—that isn't everything by long chalks. They cost more to build, run and maintain (so I hear from people in U.S.A. who operate them) need imported fuel, and do their best to poison all the passengers in tunnels. It would probably need the combined power of three units like the L.M.S.



" Old iron brought to life " by Mr. L. Boyce

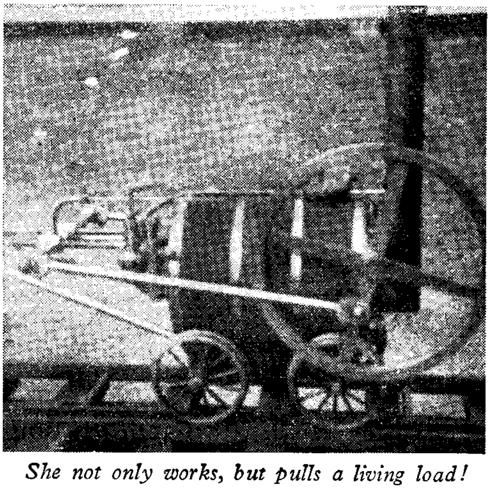
10000 to make a decent show on the Lickey; and the roar of their engines and the poisonous exhausts, would probably be worse than the combined effects of " Big Emma " and a couple of " Mollies."

Followers of these notes have suggested that a steam locomotive of the Mallet or Garratt type, with a huge boiler and 4-8-8-4 wheel arrangement, would do the trick; it was even suggested that the Garratt engine should have four cylinders on each of its " motor bogies." This would work out pretty expensive between trips, as the boiler would use a fair amount of fuel when standing. Much as I love steam, I am convinced that a three-unit " Milly-Amp " locomotive taking its power from third-rail or overhead wire, is the easiest, quietest (very important that) and most efficient way of operating the Lickey *under present conditions.* But tell it not in Gath—were I traffic superintendent of that section of British Railways, I would see that the passenger trains were made up, timed, and powered so that no banking assistance would be necessary. If a " Doris " or " Olympiade " hit the bottom of the bank at " 70 per " or over, with five or six coaches on roller bearings, she would be " up and over " before the bank engine had time to pull out of the siding. The Great Western do it on Hemerdon Bank, which is very nearly as stiff. Local traffic could be worked so that no load need be more than a powerful tank engine could take up from a standing start. It only needs a bit of careful organisation; 'nuff sed!

A 5-in. Gauge Passenger-hauling " Trevithick "

Turning from one extreme to the other, here is a short description, and a couple of pictures, of a locomotive of a type which existed long before " Milly Amps " and " diesel-electric coffee-grinders " were ever thought of. In fact it is the only little engine of this type which does a real job of work, to the best of my knowledge and belief. The late Mr. W. W. Mason built several " Trevithicks," but I have never heard of any of them actually hauling living passengers. The builder of this one is Mr. L. Boyce, of Dunedin, New Zealand, who in a cheery letter says he spent 17 years of his life at Thornton Heath, Surrey, living at a house which overlooked the goods yard at that station on my old line. Probably that had something to do with his successful effort! Anyway, here are some details of the little clink-bang. As you can see from the reproduced photographs, she is pretty correct as to appearance, with all the characteristics of the original.

The wheels are $3\frac{1}{2}$ in. diameter, and are turned from solid steel discs. A web was left in on the flange side, the spokes screwed into the hubs and silver-soldered into the tyres; the webs were then turned out, leaving tyres and hubs running perfectly true. The axles are silver-steel stubs, $\frac{3}{8}$ in. diameter, set into mild-steel beams, studded to a cast-iron block, 4 in. long, $3\frac{1}{8}$ in. wide, and $\frac{7}{8}$ in. deep. The cradles were fabricated from



She not only works, but pulls a living load!

$\frac{3}{16}$ in. by $\frac{3}{4}$ in. mild-steel, set on turned pillars on the axle beams.

The boiler is $4\frac{1}{2}$ in. diameter, made of 8-gauge copper tube, flanged outwards at both ends, which job required thirteen annealings. It was done over a former ring, which was sawn off after the job was finished. The 8-gauge end plates have forty rivets in each, and are silver-soldered as well. The firebox tube is $2\frac{1}{4}$ in. diameter, 14-gauge, flanged out at one end and riveted to the end-plate of barrel by thirty rivets, also silver-soldered. The other end comes to within $\frac{1}{8}$ in. of the end of the boiler, and is secured to it by a $\frac{1}{4}$-in. copper stud.

The grate area is $4\frac{1}{2}$ sq. in. and the bars are $\frac{1}{4}$ in. by $\frac{1}{16}$ in. steel, spaced by rollers from a scrap cycle chain. An arch is welded on at the rear end of the grate, extending to within $\frac{3}{8}$ in. of top of firebox, the part beyond this forming a combustion-chamber, to which a cross-flue is brazed; this is $1\frac{1}{8}$ in. diameter, of 12-gauge tube. The return flue is mitred and brazed to the cross-flue, and extends through the end-plate of the boiler, where it is mitred and brazed in a vertical direction to carry the chimney, which is made from the barrel of a tyre pump. A baffle-plate is fitted to the firehole door. The clearances between firebox, return flue and boiler shell, are $\frac{1}{16}$ in. at the nearest points. The lagging consists of an old felt hat covered with $\frac{1}{8}$-in. asbestos sheet, plus several yards of asbestos string, the cleading being formed by strakes of cedar, $\frac{7}{16}$ in. wide and $\frac{3}{16}$ in. thick, held by four brass bands. The dome is flat-topped, and carries a safety valve set to blow at 80 lb. pressure; steam is taken from one side, to the valve chest.

The cylinder is $\frac{3}{4}$ in. bore and 3 in. stroke, turned from 2-in. bronze rod, with a flange for fixing to boiler, and a smaller one for gland. The piston is cast-iron, $\frac{7}{16}$ in. wide, with the usual packing groove. Piston-rod and crosshead guides are $\frac{1}{4}$-in. rustless steel. The crosshead is 8 in. long, and was made from $\frac{3}{4}$-in. square key-steel. The connecting-rods are mild-steel, 11 in. centres, tapered at both ends, with split brasses held by taper pins. The driving shaft is $\frac{3}{8}$-in. mild-steel running in bronze-bushed steel housings attached to the boiler end. The flywheel is 8 in. diameter, and was turned from a piece of $\frac{5}{8}$-in. boiler plate, the spokes being formed with an Abrafile; the gears were also turned from the solid, and spokes cut same way. The intermediate gear is mounted on a stub-axle carried by a $1\frac{1}{2}$-in. flange brazed to the boiler shell, which was one reason for making it of 8-gauge copper. The gears on the wheels are carried on an extension of the wheel bush. Teeth are 16 pitch and mesh correctly, but were cut extra deep to give the "antique" appearance.

There is no water-gauge, but spring-loaded ball valves are fitted above and below the driving shaft, to serve as test cocks, and are operated by a piece of wire. A steam gauge is also provided; the full-sized engine did not have one, as they were not invented, but Mr. Boyce says he likes to know what is going on inside the boiler. He also described the valve-gear as a cross between Heath Robinson and the D.T's., but it works! The valve itself is a species of four-way cock, with a hollow plug having two flats on it. Steam enters the ports *via* a hole drilled in the plug, and exhausts *via* the flats, which connect by grooves to a common exhaust way in the valve body, into which the blast pipe is fixed. Mr. Boyce says the beat resembles an asthmatic canary, but with a 5/64-in. blast nozzle, it keeps the fire lively enough to maintain steam pressure. A blower is fitted, the steam being taken from the dome, and the pipe twisted one turn around the blast pipe, which is held in place by a three-legged spider in the chimney. The regulator is a simple plug cock.

The fire is lighted by wood soaked in methylated spirit, aided by an auxiliary blower, the embers being pushed forward, and wood and coal added alternately until there is a good fire and about 30 lb. of steam, when the engine's own blower will rapidly pull it up to blowing-off point. Fire is maintained by teaspoonfuls of small nuts. The tender is same as fitted to Stephenson's "Killingworth" engine, and contains a hand-pump.

The engine is started by setting the flywheel off dead centre, the valve being in correct position, and opening the regulator. The engine will run either way, according to which way the flywheel is pulled. She weighs only 26 lb. but hauls her $8\frac{1}{2}$-stone owner on a flat car up a grade of 1 in 360, maintaining steam comfortably, and on occasion will take an extra passenger, though very laboriously.

Hearty congratulations, Bro. "Trevithick" Boyce; you've made a job of something old Curly would shy at, and here's wishing you the best of luck on your new job, the 5-in. Stirling eight-footer.

Locomotives Worth Modelling

(*Continued from page* 119)

L.N.E.R. engines, whilst a couple of 3-in. safety valves were set at 175 lb. Steam reversing gear was placed horizontally beneath the driver's seat (an early example of steam heating?) and the cab front was provided with a small door to avoid clambering round the side of the cab. The coupling-rods had a 10-in. throw. These lovely engines would make an extremely attractive model, which would look quite fascinating in motion. The stately movement of the half-hidden coupling-rods and the swing of the Joy gear, together with the "follow-on" of the neat little tender would rejoice the heart of any locomotive lover. And what about two of them—1093 and 1392 side by side?

Useful Dimensions

Bogie Wheels	3 ft. $0\frac{3}{8}$ in. diameter
Trailing Wheels	3 ft. $7\frac{5}{8}$ in. diameter
Wheelbase: Bogie	5 ft. 6 in.
Bogie to driving axle	7 ft. $5\frac{1}{2}$ in.
Driving axles	7 ft. 6 in.
Driving to trailing	7 ft. $3\frac{1}{2}$ in.
Rear overhang	4 ft. $10\frac{1}{2}$ in.
Total length of frame	34 ft. $8\frac{3}{4}$ in.
Length of firebox	8 ft. 1 in.
Length of driving springs	2 ft. 6 in.
Tender:	
Diameter of wheels	3 ft. $7\frac{5}{8}$ in.
Wheelbase	10 ft. 6 in.
Water	2,290 gallons
Coal	5 tons

IN THE WORKSHOP

by "Duplex"

*16—Modifications to "The Model Engineer" Drilling Machine

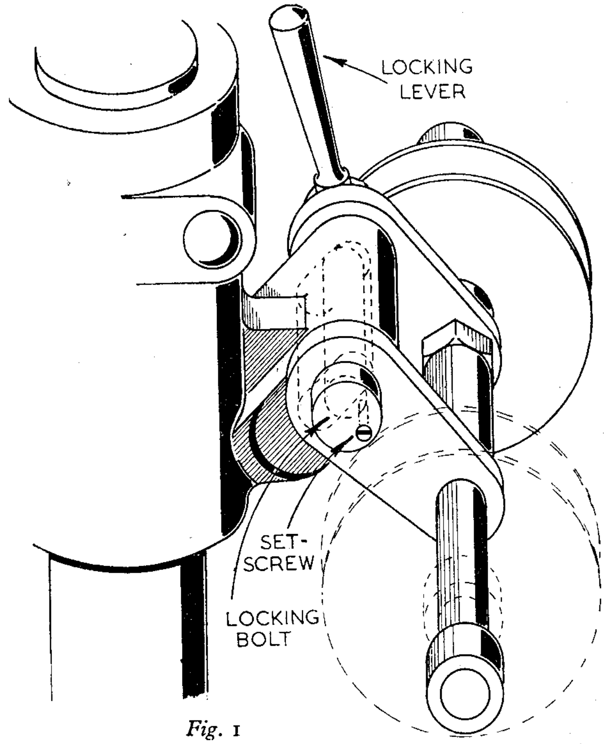


Fig. 1

WHEN using very small drills in a machine of this type, it is essential that the feed should be really sensitive to allow the pressure applied to the drill by hand to be accurately gauged.

Where a return spring is employed to raise the drill spindle, the hand pressure required to feed the drill will necessarily increase as the spring is extended, unless, of course, a more complicated mechanism than is generally fitted is used to keep the spring loading constant.

It was decided, therefore, to use a counterweight instead of a spring, and this weight was set so that it only just returned the drill spindle to the fully-raised position.

The counterweight was made from a $1\frac{5}{8}$ in. length of $1\frac{1}{2}$ in. diameter round, mild-steel bar, and was positioned with its centre $3\frac{5}{16}$ in. from the upper pivot axis of the swing links.

The weight was drilled axially to receive the $\frac{1}{4}$ in. diameter weight shaft screwed into the left-hand distance-piece; after adjustment, the weight was secured in place by means of a grub-screw fitted on its under-side.

The Feed Lever

When the machine was finished, a trial feed lever 4 in. in length was fitted, but it was found that the hand pressure which had then to be exerted was too great to permit of satisfactory and controlled feeding of the drill.

On looking into the problem, it was found that the leverage obtained in the larger $\frac{3}{8}$-in. drilling machine, fitted with a rack feed, was 16 to 1 when a 6-in. feed lever was used.

With this machine an $\frac{1}{8}$-in. drill cut two thick spiral chips in mild-steel with only light hand pressure, and moreover, when the drill was nearly breaking through the work, there was no danger of its finishing the hole with a rush, as may happen when heavy pressure has to be exerted on the feed lever.

A long experimental lever was, therefore, fitted to the sensitive drill, and it was then found that the drill penetrated at about half the above rate when a pull of 6 lb. was exerted with a spring balance at a distance of 9 in. from the thrust block trunnions. As the distance from the trunnions to the anchor point of the feed gear is 2 in., this gives a leverage of $4\frac{1}{2}$ to 1, or a pressure of 27 lb. at the drill point.

This figure is quite in keeping with the result of a previous experiment, which showed that a pressure of some 40 lb. was required to give normal penetration with a sharp high-speed steel drill.

The figures quoted do not, of course, take into account losses due to friction in the operating gear, and they merely serve as a guide to the leverage required for moderate or normal penetration of the drill in mild-steel.

As a longer lever would have looked unsightly and only a moderate rate of penetration with small drills was required, it was decided to fit a feed lever having a total length of 9 in., measured from the thrust block centre-line.

A second visit to the car-breaker and the expenditure of 2s. produced the complete steering

**Continued from page 73, "M.E.," July 15, 1948.*

column controls belonging to a Talbot, this furnished two well-made spherical knobs from the finger levers and several feet of heavy gauge steel tubing.

A length of the latter was used for the feed lever, and one of the ball knobs was fitted to its end to complete the work.

While on the subject of drilling pressures and feeds, it is interesting to see what the drill makers have to say. Apparently, an $\frac{1}{8}$-in. high-speed steel drill running at 2,800 r.p.m. will penetrate into mild-steel at the rate of 15 in. a minute, that is to say it will drill to a depth of 1 in. in 4 seconds.

Although the pressure required to achieve this result is not stated, it must be much greater than we have allowed for in the previous calculations. This speed of drilling is, of course, not required in the small workshop and would even be a serious disadvantage at times, but on the other hand, the feed pressure must always be sufficient to keep the drill cutting, for if it is allowed merely to rub the work, the cutting edges will be quickly blunted at high speeds, or when alloy steels are being drilled which are apt to work-harden, as it is termed.

In the latter case, the work surface becomes extremely hard, especially when machining stainless steels, and it will then be found difficult to continue the drilling operation owing to the rapid blunting of the drill. However, what has been said on the subject of drilling pressures does show that the feed mechanism of even the small drilling machine may be subjected to considerable stress, and it should, therefore, be designed accordingly and constructed to withstand the friction and wear of the moving parts that may arise under these conditions.

The Jockey Pulley Mechanism

As a larger drilling machine was already in use in the workshop, it was decided that the smaller machine did not need to have a very wide speed range, and that a single V-pulley on the motor shaft would be sufficient for nearly all purposes ; but to obtain the very high speeds that would be necessary on the occasions when the smallest drills were used, a second, larger, pulley was also fitted to the motor mounted on the under-side of the bench.

This arrangement entailed a greater range of adjustment than was provided in the original design, and although the lug on the head casting was slotted, additional movement of the jockey pulleys was found necessary to allow for belt tensioning.

To meet these conditions, a swinging bracket was made to carry the jockey pulley shaft as illustrated in Fig. 1, and although the range of adjustment was then found to be adequate, it can, of course, be further increased by fitting longer swing-links, or by lengthening the slot in the head casting.

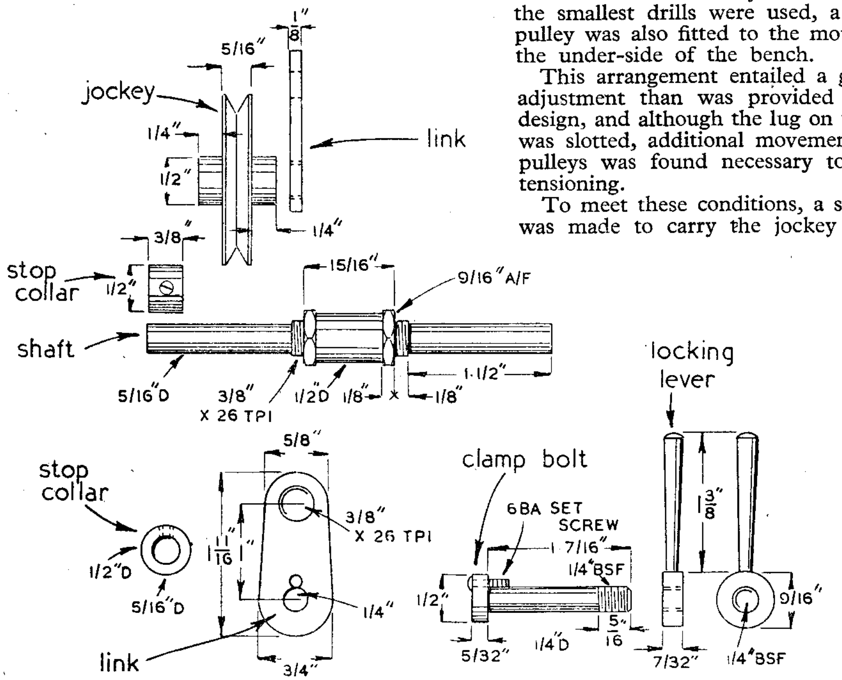


Fig. 2

The jockey pulley spindle was first made by machining a length of $\frac{1}{4}$-in. Whitworth nut-size bar between the lathe centres, and in accordance with the dimensions given in Fig. 2.

The projecting ends of the shaft on which the jockey pulleys run was finally lapped to a high finish, for if this is not done it will be found that the pulleys, when revolving at high speed, will emit a roaring sound, but with lapped contact surfaces they will run almost silently ; in fact, the whole machine, even when running fast, should not give rise to more than a faint hum if all the moving parts have been carefully fitted ; and, moreover, this high finish will greatly enhance the machine's good wearing qualities.

If, on the other hand, either or both of the bearing surfaces have a rough finish, this roughness will be comparatively quickly worn away and slackness in the bearing will develop prematurely.

Evidence of the wear taking place will be

furnished by the blackened oil coming from the bearing; this discoloration of the oil is due to the presence of fine metal particles, and occurs, also, when an abrasive substance gains entry to the bearing surfaces.

In a well-protected, lapped bearing, however, the oil keeps clean, and even after prolonged running the oil will not soil a clean piece of rag. Moreover, the detached metal particles suspended in the oil will themselves cause further wear, and should discoloured oil be found coming from a machine, the bearings in question call for prompt attention.

The two sheaves or swing-links are threaded and screwed on to their respective seatings on the shaft, and in order to fit them securely in place it may be found necessary to take a fine cut over the face of one seating, so that some force has to be used to bring the links into alignment. If this work is properly carried out, there should be no need to give further security by cross- or side-pinning, as the turning force exerted on the parts when the machine is in operation is very small.

The jockey pulleys themselves are turned to the dimensions shown, and the bores are finally lapped to allow them to turn smoothly on the shaft.

The general appearance of the machine will be improved if the jockey pulleys and the main driving pulley are polished, and in addition, parts so finished are more easily kept clean than when left in the rough state after turning.

When cast-iron is turned in the ordinary way, the grain of the metal is opened up and the surface appears to be evenly spotted with small black dots. The use of a broad-faced spring turning tool will improve this appearance, but a uniform surface is, perhaps, best obtained by the application of a fine file while the parts are revolving at a moderate speed in the lathe.

It is as well to use an old file for this purpose, as it will be quickly blunted if the speed is too high.

It is essential to use fairly heavy pressure, as this tends to compress the surface of the work and improve its finish.

After the file, various grades of carborundum cloth are used; the cloth should be well oiled, and when supported by a file is applied to the work with moderate pressure until a well-polished surface is obtained.

The small stop collars fitted to the ends of the pulley spindle are retained in place by means of a flush-fitting grub-screw engaging a dimple formed on the under-side of the shaft.

It now remains to fit the locking bolt to secure the jockey pulley bracket in position after adjustment.

The bolt itself is prevented turning by means of a set-screw or snug engaging the side link, but in the design shown in the drawing the length of the locking lever is such that it cannot make a full turn, as its movement is limited by the position of the pulley shaft.

If the locking lever is shortened, or the links are lengthened, to allow the lever to turn, then the snug can be permanently fixed in the head of the locking bolt; but if the dimensions shown in the drawing are adopted, the locking bolt must be screwed into the locking lever while the latter is held stationary, and the set-screw is then inserted.

An alternative method of simplifying the construction is, of course, to use a hexagon nut to replace the locking lever, but this means that the machine cannot then be set solely by hand, as is so desirable for convenience of operation.

Drill Table Stop Collar

A stop collar, when fitted below the drilling table, will be found most useful when the table has to be moved to the side, whilst, at the same time, it is necessary to maintain its adjustment for height.

The fitting shown in Fig. 3 consists of a collar which slides on the column of the drilling machine and is secured in place, after adjustment, by means of a handled set-screw; a brass pad-piece is fitted at the end of the screw to prevent damage to the column.

In a future article we hope to describe a combined depth drilling stop and graduated depthing gauge that we have fitted to a MODEL ENGINEER

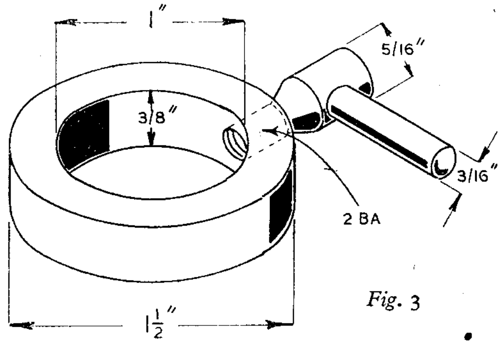


Fig. 3

drilling machine, but which should be suitable for application to any machine of similar type.

The use of this component, in conjunction with the table stop collar, makes exact depth drilling of widely-spaced holes an easy and certain operation.

Lubrication

It is very important that a high-speed machine of this type should be provided with a means of supplying adequate and continuous lubrication to the rotating parts.

As the bearings are very closely fitted, only a very thin oil should be used, and preferably one which does not readily oxidise and become tacky.

We have already seen that the upper end of the spindle is drilled to provide a reservoir for feeding oil to the thrust block bearing through a duct drilled radially in the shaft.

To provide for the lubrication of the main spindle bearings, two lubricators were fitted to the bearing lugs. These are shown in Fig. 4, which depicts both the short-necked pattern *B* for the upper bearing and the extended lubricator *A* that is needed to reach beyond the driving pulley when fitted to the lower bearing.

It may be thought that these lubricators are unduly small and that it would be an advantage to have large oil-wells; but, in practice, it is safer

to supply a small quantity of oil to the lubricators, whenever the machine is used, rather than to trust a large lubricator to maintain a supply of oil over a long period.

If the chain roller-bearings fitted to the feed gear are greased when the machine is assembled, they will need no further attention for a long time, for their highly-finished hardened surfaces will enable them to work satisfactorily even in the dry state, and the lubricant is here used largely to prevent corrosion, as in the case of ball-bearings.

As will be seen in the drawings, the lubricators are built up to save unnecessary machining. Both the long and the short pattern nipples shown in Fig. 4, *D*, are screwed into the reservoir, *C*, and are then sweated in place to make a firm joint.

Washers are fitted between the nipple and the spot-faced seating machined on the bearing lug, both to make an oil-tight joint and to bring the lubricator into the upright position.

It is advisable to fit a thread of wick in the oil passage to allow the oil to seep through slowly and so make the supply more continuous.

Driving the Machine

A sewing machine belt will be found quite satisfactory for driving the machine from a ¼-h.p. electric motor, for these belts are made of leather of high quality and do not appear to stretch appreciably when in use.

It is essential that the U fastener should be correctly fitted, that is to say, it must be exactly in the centre-line of the belt, and the two ends of the belt should butt firmly together so that the leather cannot work on the metal fastener and be worn away at this point. As the joint made in this way is more rigid than the remainder of the belt, very small pulleys should not be used, as this causes the belt to be bent too acutely and breakage at the fastener holes is apt to result.

Although it is usually advised that the fastener holes should be formed with a pointed awl so as not to cut the fibres of the leather, this procedure results in the ends of the belt being expanded when the fastener is inserted, thus causing the belt to jump as it strikes the pulleys unless the leather is pared away. Nevertheless, we always drill the ends of the belt with a $\frac{1}{16}$-in. drill when fitting a fastener and we have never had any trouble from broken belts, provided that the leather was in good condition.

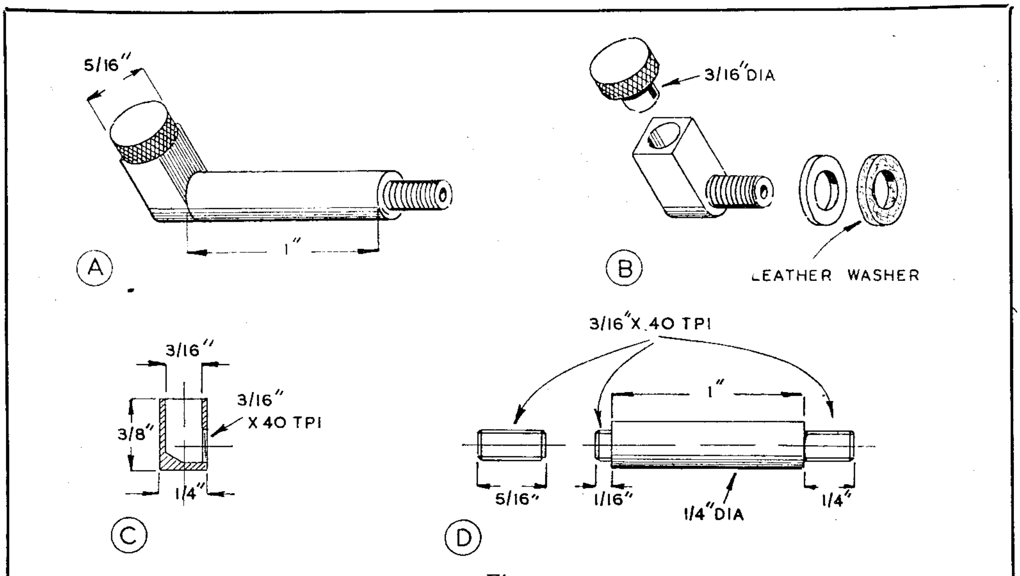


Fig. 4

Care should be taken to ensure that the fastener does not bottom in the V of the pulleys, as this sets up an annoying click as well as possibly causing vibration.

For those who dislike fasteners in any form, endless round belts can now be obtained in all sizes used for driving small machine tools.

In order to collect some, at least, of the chips that fall from the drilling machine, it is advisable to fit a chip tray below the drill table.

The lid of a square biscuit tin serves excellently for this purpose, and it should be retained in place with a couple of studs driven into the bench top and fitted with knurled terminal-nuts. The tin is best painted with cellulose paint, as this is not stained by the oil which is sure to fall from above.

In concluding the second part of this article, we must again lay emphasis on the remarks that were made at the commencement of the first part, namely, that the modifications which we have made to THE MODEL ENGINEER drilling machine in no way imply any criticism of Mr. Westbury's excellent work in designing it. Such modifications and additions were made solely to meet our own special needs, and it is greatly to Mr. Westbury's credit that the fundamentals of the machine are so sound. Were it not for this, we should have been wasting our time.

Editor's Correspondence

Magnetic Clock Escapement

DEAR SIR,—I should like to reply to the letter by Mr. T. C. Moorshead concerning the magnetic escapement described in a previous article by Mr. Westbury.

This letter gives the impression that this escapement is not suitable for really accurate work, but I have here before me some tests which have been made using this escapement, and should prove interesting to your readers.

Using a one second wooden pendulum, it has been found easy to construct a clock capable of keeping time to within $\pm$ 2 secs. per week.

Using a 1 sec. Invar pendulum, the error can be reduced to practically the theoretical variation due to change of barometric pressure 0.35 secs. per day per inch of mercury.

To close, may I mention that there is one big advantage which has not been mentioned, and that is that the clock is absolutely silent.

Yours faithfully,
Dudley. P. D. SIMPSON.

DEAR SIR,—In reply to the letter by Mr. T. C. Moorshead, in which he suggests that the clock referred to is far from being as perfect as I would have readers believe, I would like to state that no attempt was made to represent the device as ideal from the aspect of exact timekeeping. What I did say, and what I still maintain, is that it enables a clock to be made which will keep reasonably accurate time, and maintain it under normal working conditions, better than the majority of ordinary clocks built to the usual commercial standards.

It is a well-known fact that the most perfect forms of escapements rely very largely on extreme accuracy of construction, and the use of materials of the utmost durability, and if these conditions are not observed, their full advantages are not realised. There is very good reason to believe that a clock with, say, the Grimthorpe gravity escapement made to the standards of accuracy of a cheap alarm clock would be little, if any, better than the latter in timekeeping properties, at least after its initial newness had worn off.

The elimination of mechanical friction which is rendered possible by the magnetic escapement, constitutes a great practical improvement in so far as clocks made to ordinary commercial standards, and with the usual materials, will work better and last much longer, besides using less power.

It is true that the timekeeping properties of the magnetic escapement are influenced by the amount of force applied to the wheel train, but this could, if necessary, be avoided by reverting to weight-driven wheel trains, or the use of a fusee in spring-driven clocks. In practice, ordinary spring-driven clocks without this provision give reasonably satisfactory results, and the timekeeping properties of the magnetic escapement under such conditions would certainly be no worse than many clocks, the errors of which are considered tolerable.

I have not suggested that the magnetic escapement would supersede the best types of escapements for precision timekeeping, and I do not think that the inventor of the escapement would claim that either.

Incidentally, I would like to see more interest taken in the construction of clocks by readers of THE MODEL ENGINEER, as interest in this subject appears to have fallen off somewhat during recent years. I know that it can be argued that clock making is not model engineering, but it is an extremely interesting branch of precision metal working which is within the scope of most amateurs, and produces results which are highly satisfying and can be appreciated by everyone. Many model engineers have, at some time or other, engaged in clock construction, and I have seen some most excellent results of their endeavours, but for some reason or other they hesitate to bring them into the limelight. Incidentally, it has been suggested that one of the reasons why clock making is not more popular is because of the difficulty of obtaining exact information on the action of escapements and other essential parts; but there are now some excellent books on the subject, and readers who have access to back volumes of THE MODEL ENGINEER will also find plenty of useful information thereon by Mr. George Gentry and other contributors.

Yours faithfully,
Surrey. EDGAR T. WESTBURY.

That Unusual Locomotive Valve-gear

DEAR SIR,—May I amplify Mr. Cosgrave's excellent letter concerning the valve-gear described by Mr. Burdett in THE MODEL ENGINEER for April 8th?

Messrs. Manning Wardle, of Leeds, supplied three 2-6-2 tank locomotives in 1895 and a fourth to the same design in 1925, to the now defunct Lynton & Barnstaple Railway.

It was on these four engines that this form of Joy's valve-gear was used, in addition to the examples mentioned by Mr. Cosgrave.

Yours faithfully,
London, N.W.7. F. C. R. DOUTON.

Slotted Screws on Locomotives

DEAR SIR,—This letter is prompted by the excellent articles by Mr. J. Austen-Walton *re* "Centaur" (incidentally, the model in question was much admired by the writer at the last MODEL ENGINEER Exhibition).

It would appear that Mr. Austen-Walton has read and marked all the correspondence in the columns about the use of slotted screws, cheese-head and otherwise, in scale locomotives, and has therefore been at some pains to avoid them.

Inspector Meticulous or his grandpa must have bad eyesight; he has only to stand on the platform near any railway locomotive and he'll count plenty!

I have been on a good many locomotives; started cleaning them in 1917 and now driving them, and *every one of them* has had slotted

screws used in its construction. For instance, today my fireman and I went to the trouble of counting all slotted screws that were actually showing, and in full view of anyone interested. Engine No. 4317, L.M.S.R. Standard Freight, 0-6-0, staioned at Saltley, Birmingham, has no fewer than 206 (two hundred and six), eight of them are countersunk slotted screws no less than $\frac{7}{8}$ in. diameter, situate in the running boards, front end, 44 cheese-heads, three specially-shaped slotted screws, and all the rest slotted round (snap) heads, *each and every one slotted* for the despised screw-driver!

By the way, my own model, exhibited at the "M.E." Exhibition, 1935, also had slotted screws in the running boards, in correct place. I often wonder if the judges knocked off any marks because of them!

The writer hopes these few lines will settle the "slotted-screw controversy" and save space in "Ours"; all that is required regarding the small edition is that they are used in the correct places; what's right on the prototype is obviously bound to be right on "little sister"!

Yours faithfully,

Tamworth. A. E. WILLIAMSON.

Club Announcements

The North London Society of Model Engineers

The society recently paid a visit to the Ramsgate Model Engineering Club, and still more recently entertained the Enfield Model Engineering Society. We hope we may have the pleasure of exchanging visits with other societies.

Members are working hard in preparation for our exhibition, which will be held at Ewen Hall, Barnet, between September 1st and 4th inclusive.

Amongst the exhibits will be a Round-the-Pole Timing Apparatus for boats or cars, which has been developed by the Science and Research Section. A feature of this apparatus is that it produces a permanent record of each lap.

Hon. Secretary: N. M. Dyer, 97, Selborne Road, N.14. (Phone: Palmers Green 2414.)

Hastings and District Society of Model and Experimental Engineers

On Sunday, July 4th, a party of members and friends of the above society paid a very enjoyable visit to the Romney Hythe & Dymchurch Light Railway.

Upon arrival, we visited the locomotive sheds, workshops and the display of models. Unfortunately, a power cut prevented our seeing the wonderful "O" gauge layout in operation then, but all was in order later, on our return from Hythe. The general manager, Mr. J. T. Holder, drove "Hercules," which hauled our train, on which we were accompanied by a party from the Willesden Society. After members had enjoyed a good tea arranged for us at Hythe, a special train was laid on for the return to New Romney. Again 4-8-2 "Hercules," driven by Mr. Holder, headed the train.

Mention should be made of the warm reception accorded us at Hythe by the stationmaster, Mr. Champion, and, in fact, of the friendly way we were received all round. The only snag was the weather; it rained non-stop all the time, but in spite of that a tired but very happy party returned to Hastings.

Hon. Secretary: L. J. MARKWICK, 577, Bexhill Road, St. Leonards.

Croydon Society of Model Engineers

The club has recently enjoyed several interesting talks by members including one by the secretary on June 24th on the subject of "Cutting Tools." A "Bits and Pieces" night will be held on August 19th and the next Rummage Sale will take place on September 3rd.

Hon. Secretary: J. F. STRINGER, 59, Windmill Road, West Croydon.

I.W. Model Engineering Society

An exhibition is being held by the above society on August 18th, 19th, 20th and 21st. It is being staged in the Secondary School's Lecture Hall, Newport, I.W., and will be open at 6.30 p.m. on August 18th, 2.30 p.m. on the 19th and 20th, and 10.30 a.m. on Saturday, August 21st.

Loan and competition sections have been organised and the I.W. M.E.S. will be pleased to hear from "lone" hands, giving a special welcome to holidaying model engineers to come over to Newport and see us.

Meetings for August are:—

August 7th. Final exhibition details.
August 18th, 19th, 20th, 21st. Exhibition days.
August 28th. To London for "M.E." Exhibition.

For full particulars and entry forms, the Hon. Secretary, V. C. RICHARDS, 13, Chapel Street, Newport, I.W., will be pleased to oblige.

Eltham and District Locomotive Society

The next meeting will take place on September 2nd, 1948, at the "Beehive Hotel," Eltham, which will be a Rummage Sale. The usual August meeting will not take place, as the society, in conjunction with other clubs, will be dealing with the annual exhibition at Bromley. At the last meeting three new members were enrolled, and a record attendance of members took place.

Hon. Secretary: F. H. BRADFORD, 19, South Park Crescent, Catford, S.E.6.

Huddersfield Society of Model Engineers

The annual open event was held in the Highfield Operational Centre on Saturday, July 10th. Over 200 members and friends attended. Ten steam locomotives were running on the new track, which had been laid by a number of members.

The boating section was well represented by speed, steam and radio-controlled boats.

Secretary: F. W. L. BOTTOMLEY, 763, Manchester Road, Huddersfield.

Guildford Model Yacht, Power Boat and Engineering Society

Club activities have been many and varied during the past months, having included talks by Mr. Ian Bradley and Mr. E. T. Westbury; "get together" and "Bits and Pieces" nights have proved attractive. The highlight of the season was perhaps the trip to the Romney, Hythe and Dymchurch railway, which, thanks to the interest and help of the general manager of the railway, was a great success.

Power boat member Frank Jutton is having a very exciting season at regattas, breaking records and winning cups!

Mr. Fred Love's "Bantam Cock" has been doing some good work at various fetes in the district, with the help of track loaned by the Godalming Club. We hope to start work shortly on our own track, as we have received permission from the Guildford Corporation to erect a 200 ft. portable track in Stoke Park, which it is hoped will be a prelude to a permanent track of about 800 ft.

Future activities include the annual regatta to be held at the pond in Stoke Park on Sunday, August 15th, commencing at 11 a.m., to which visitors will be very welcome. It is hoped to arrange an outing to Vickers-Armstrong works at Weybridge, and another to "The Royal Anchor" at Liphook to see the collection of models there. Details of talks and other meetings for the autumn and winter will be announced later, but mention should be made of the Guildford area exhibition, which is to be held on October 20th to 23rd inclusive. We hope to make this an even better show than our first effort last year.

Secretary: H. R. HADLOW, 20, Merrow Woods, Guildford.

NOTICES

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. **All such correspondence should be addressed to the Editor (and not to individuals)** at 23, Great Queen Street, London, W.C.2. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All correspondence relating to sales of the paper and books to be addressed to THE SALES MANAGER, Percival Marshall & Co. Ltd., 23, Great Queen Street, London, W.C.2.

Correspondence relating to display advertisements to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 23, Great Queen Street, London, W.C.2.